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Monterey, California

THESIS

A SIMULATION MODEL OF ISSUE PROCESSING AT NAVAL
SUPPLY DEPOT YOKOSUKA, JAPAN

by

Michael S. Clift

Thesis Advisor: F. M. Perry

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A Simulation Model of Issue Processing at Naval Supply Depot Yokosuka, Japan

by

Michael S. Clift
Lieutenant, Supply Corps, United States Navy
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Submitted in partial fulfillment of the
requirements for the degree of

MASTER OF SCIENCE IN INFORMATION SYSTEMS

from the

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ABSTRACT

A computer simulation program has been written in IBM's GPSS V to model the issue processing functions of U.S. Naval Supply Depot Yokosuka, Japan. The results of simulation experiments that may be conducted with the model can be used by analysts in the Planning Division of the Naval Supply Depot to predict actual Depot performance under conditions of surge demand.

TABLE OF CONTENTS

I. INTRODUCTION 7

A. THE PROBLEM 7

B. THESIS OBJECTIVE 9

C. SCOPE 9

D. LIMITATIONS 10

1. Data Collection 10

2. Microcomputer Simulation 10

E. ORGANIZATION OF THESIS 11

II. MODELING TECHNIQUES 12

A. OPERATION RESEARCH 12

B. SIMULATION 13

C. SIMULATION LANGUAGES 16

D. GPSS 18

III. THE SYSTEM TO BE MODELED 21

IV. THE MODEL 27

A. DEFINITION 27

B. STRUCTURE 28

1. Requisition Generation 29

2. Work Scheduling 31

3. Workcenter Operations 32

4. Requisition Flow Control 33

5. Printer Operations 35

6. Transportation Operations 35

7. Duty Section Operations 37

V. VERIFICATION AND VALIDATION 40

A. INTRODUCTION 40

B. VERIFICATION 43

NAVAL POSTGRADUATE SCHOOL
MONTEREY, CALIFORNIA 93943-5002

C. VALIDATION 44

VI. EXPERIMENTATION 47

VII. SUMMARY 51

A. CONCLUSIONS 51

1. Discrete Event Simulation Using GPSS V . . 51

2. Discrete Event Simulation Using GPSS/PC 51

B. RECOMMENDATIONS 51

1. Data Collection 51

2. Model Experimentation 52

3. Microcomputer Implementation of the Model 52

APPENDIX A: PROGRAM LISTING 53

APPENDIX B: GPSS BLOCK DIAGRAM 99

APPENDIX C: PROGRAM OUTPUT 125

LIST OF REFERENCES 136

BIBLIOGRAPHY 137

INITIAL DISTRIBUTION LIST 138

LIST OF FIGURES

3.1 Physical Layout 22
3.2 Flow Diagram 24

I. INTRODUCTION

A. THE PROBLEM

The U.S. Naval Supply Depot Yokosuka, Japan (NSD Yokosuka), is tasked with providing logistics support to U.S. Navy fleet units and shore activities in the Japan and Northern Pacific operating areas. As the major U.S. Navy logistics installation in Japan, NSD Yokosuka is the primary source of logistics support for all Navy and Marine Corps shore activities based in Japan. Fleet units supported by NSD Yokosuka include eleven homeported ships as well as deployed ships of the Seventh Fleet. Although NSD Yokosuka's major function is material support, it also provides essential supply services. The Freight Terminal Division is responsible for transshipment to the requisitioner of issue priority group one material received from stateside Naval Supply Centers and Defense Logistics Agency (DLA) activities. The Depot also manages a variety of other support services including contracting, data processing, accounting, disbursing and personal property shipment.

In addition to its basic fleet support role, NSD Yokosuka is tasked with tri-service support responsibilities for fuel and subsistence. NSD Yokosuka is the DLA Designated Specialized Support Point for provisions in Japan, providing subsistence support to all fleet units, DoD commissaries and troops in the Japan operating area. As the DLA agent for fuel, NSD Yokosuka operates the largest fuel complex in the Pacific. The Fuel Department provides bulk petroleum products to all military activities in the Western Pacific and maintains Prepositioned War Reserve Stock (PWRS) inventory levels to meet the anticipated combined requirements of the services in that area.

NSD Yokosuka is strategically positioned to support contingency operations in the Far East. Any conflict in the Northern Pacific, Korea, or other Southeast Asian country requiring extensive deployment of ships, aircraft and troops will result in a surge of activity for NSD Yokosuka. If the conflict is not short-term in duration, the increased operating tempo could be expected to result in new manpower requirements, multi-shift operation of the NSD and its detachments, possible expansion of physical storage facilities and the acquisition of additional material handling equipment. NSD Yokosuka's ability to respond to a surge in demand for logistics support brought about by a period of increased tension or open conflict is a critical issue to planning military operations in the Far Eastern theater. The NSD's effectiveness in this type of scenario hinges on its ability to escalate operations in a short time frame. Counter to the rapid response required of NSD Yokosuka in a contingency situation is the relative difficulty of mobilizing the necessary manpower and other resources on short notice. Planning specific requirements in advance and identifying sources to fill those needs is essential to maintaining supply readiness at NSD Yokosuka.

Predicting future resource requirements of the Depot is a primary function of the Planning and Comptroller Department, more specifically, the Planning Division. In any operating environment, NSD Yokosuka seeks to minimize the processing time associated with issuing material to customers while maximizing the availability of other support services required. To this end, the Planning Division projects the volume of demand that the Depot will be expected to support in various operational scenarios, i.e., positioning of an additional carrier battle group or a build-up in troop levels. Divisional requirements in support of those levels of operation are estimated. The consolidated requirements of the Depot are quantified and plans outlining the allocation of resources among divisions are formulated.

B. THESIS OBJECTIVE

The objective of this thesis is to provide a predictive and quantitative tool to support the contingency planning efforts of NSD Yokosuka. A computer program modeling the issue processing functions of the Depot will be constructed. The program will be written in IBM's General Purpose Simulation System V (GPSS V). The completed program may be used to conduct experiments simulating Depot performance under conditions of surge demand. The information gathered in a controlled series of experiments with the model can be used to help formulate operating policy and resource distribution plans to cope with contingency situations.

C. SCOPE

The scope of the model will be limited to those functions of NSD Yokosuka in direct support of issue processing operations, from requisition receipt to the point of availability of the issue for shipment to the requisitioner (or the point of actual delivery to the requisitioner in the case of bearer walkthroughs, quick picks and issues delivered to Naval Base Yokosuka activities by NSD tractor trains). A detailed list of the actual processes to be simulated is provided in Chapter IV. Other Depot operations have been excluded for the following reasons:

1. The complexity of a model can be expected to increase as the scope of the system to be simulated is expanded. Limiting the scope of the system to mainstream issue processing functions will provide important information to analysts while keeping model modification and experimentation within the capability of personnel without extensive simulation experience.
2. The scope of the system to be simulated is also limited by the capabilities of the software and hardware on which it is implemented. The memory requirements of a program written to simulate all major functions of the Depot would exceed the maximum amount of memory addressable by GPSS V.

3. Model design and validation imposes substantial data collection responsibilities on the NSD Planning Division. Depot personnel resources were taxed to meet the data requirements imposed during development of the model of issue processing functions.

4. Some functions of the Depot are sufficiently complex to form the basis of major simulation projects by themselves. Inventory Control Department, Data Processing Service Center (DPSC) and Freight Terminal Division operations are all candidates for separate simulation projects.

5. Not all systems can be simulated with discrete simulation methods. The Fuel Department manages several processes that are best modeled by continuous simulation methods.

D. LIMITATIONS

1. Data Collection

Construction and validation of the model was hampered by difficulties experienced by the author during data collection. Due to the physical separation of NSD Yokosuka from the Naval Postgraduate School, the data collection effort was managed by the NSD Planning Division. Personnel from cognizant divisions of the Depot were tasked with collecting the data from retained records or by observation of the physical processes. The time-intensive nature of random sampling slowed the process of data collection. This was aggravated by competing operational requirements in the Inventory Control and Material Departments. At the time of this writing, the collection of service time samples for the Packing Section and half of the material storage areas remained incomplete.

2. Microcomputer Simulation

The initial objective of this thesis was to model NSD issue processing operations on a microcomputer. Efforts in that direction were blocked by the memory requirements of the program. The technical details of this limitation are discussed briefly in Chapter II of the thesis.

E. ORGANIZATION OF THESIS

The balance of this thesis is devoted to the examination of simulation as a logistics planning tool and to the development and validation of a program to be used for simulation experimentation. In Chapter II, the suitability of simulation and other operations research disciplines to supporting logistics planning efforts is reviewed. A description of issue processing at NSD Yokosuka, the system to be modeled, forms the basis of Chapter III. Chapter IV utilizes GPSS block diagrams to explain the simulation program structure. Program verification and a discussion of program validation are presented in Chapter V. Guidance in experimentation techniques and a discussion of simulation experiments conducted by the author are included in Chapter VI. Recommendations and conclusions in Chapter VII will address further simulation experimentation and the observed benefits of simulation in supporting logistics planners.

II. MODELING TECHNIQUES

A. OPERATION RESEARCH

NSD Yokosuka's ability to provide the level of logistics support required by DoD activities in the Japan operating area is a product of the combined efforts of several work-centers. The DPSC Department and the Customer Services, Requirements, Storage, Labor and Equipment and Freight Terminal Divisions all perform tasks integral to the processing of requisitions received by NSD Yokosuka. Because a decision made in one division may affect the operations of another, the performance of individual divisions must be evaluated in terms of their contribution to overall Depot performance. This interaction between functional areas must be taken into account by the Planning Division during the formulation of operating strategies for surge demand environments. Operations research techniques incorporate the systems approach and can serve as an important logistics planning tool.

Operations research is a collection of mathematical tools that may be applied to solve practical decision problems within a system [Ref. 1]. The aim of operations research analysis is to evaluate the probable consequences of decision choices. These choices are typically concerned with the allocation of scarce resources within the system. Most methods of operations research use models to study the actual system [Ref. 2: p. 4]. Models represent objects of interest within the system as entities, the characteristics of entities as attributes and the interactions causing change within the system as activities. Models are employed when experimentation with the actual system is not a practical approach to analyzing operations. Accordingly, formulation of a model is a suitable method of predicting the performance of a supply depot under conditions of surge demand.

Specialized operations research techniques have evolved to handle certain well-defined classes of systems problems. Network analysis may be used to solve transportation problems. Inventory algorithms are used to make inventory control decisions. These techniques are well suited to narrowly-defined problems and are regularly employed by the military to solve logistics problems. The study of broader, less well-defined systems require more generalized mathematical techniques.

Mathematical analysis is applied to systems management problems by representing attributes of the system as variables and activities as mathematical functions that interrelate the variables [Ref. 3: pp. 8-9]. Mathematical analysis is a sophisticated operations research technique that can be used only by analysts with extensive backgrounds in mathematics. It is not always possible to formulate a complete mathematical model of a complex system. The combined effects of uncertainty, dynamic interaction between decisions, interdependency among variables and the representation of processes over long time horizons are difficult to represent mathematically and may require alternative methods of research [Ref. 4: p. 142]. Stock point analysis problems fall into this category. The stochastic nature of requisition arrival and processing times, overlap between the operations of separate divisions within a supply depot, the relationship of requisition priority and type to the processing procedures followed and the need to observe operations over extended periods of time all support the use of computer simulation as a research tool.

B. SIMULATION

Simulation is the process of designing a model that duplicates the dynamic behavior of the essential characteristics of a system for the purpose of studying that system [Ref. 5]. It is a popular technique among operations research practitioners. In a survey by Weston [Ref. 6] of 1000 U. S. firms, it was the most frequently employed quantitative tool. Simulation is also used extensively by the military to evaluate weapons and logistics systems. Because the structure of a simulation model bears a close relation to the logical structure of the real system, model development is simplified. Schmidt [Ref. 7] notes that the level of mathematical sophistication required to develop a simulation model of a complex system is generally less extensive than that required to develop a mathematical model, underscoring simulation's relative ease of use. It is this simplicity that makes simulation intuitively popular to analysts.

Simulation is a versatile operations research technique. It may be used as a descriptive tool (to describe a current system) or as a predictive tool (to explore a hypothetical system or design improvements to a current system). Simulation is also flexible with respect to changes in the actual system. Variables can be modified before a simulation is run, or dynamically, to align the model with real system conditions.

There are drawbacks to the use of simulation. Simulation does not optimize in the sense that calculus-based analytical methods do [Ref. 3: p. 38]. Optimal solutions may be obtained only through repetition of simulation experiments. Simulation models produce less precise results than does mathematical analysis [Ref. 2: p. 13]. Due to the probabilistic nature of simulation, the results of simulation experiments repeated in succession can be expected to vary and the sensitivity of a simulation model to changes in the value of input variables is not subject to exact measurement. Simulation models experience the same problems as models employed in other techniques of operations research. They may appear to accurately reflect the real system, when in fact, they do not. Simulation models, as all others, will yield incorrect results if they are not validated carefully.

There are two major types of simulation, continuous and discrete [Ref. 4: p. 143]. Continuous simulation is concerned with systems that change continuously with respect to time and with measurements that are not restricted to integers. Refinery operations and rocket trajectories are examples of systems that are studied by the use of continuous simulation. In discrete simulation, the simulated time advances in a stepwise discrete fashion. A discrete simulation is time-oriented if the simulation clock is updated at regular time intervals. If the clock is updated by the scheduled occurrence of events, the simulation is termed event-oriented. Discrete event simulation lends itself especially well to the modeling of queuing systems and, therefore, is generally applicable to modeling the performance of service organizations that can be represented as a collection of service facilities and queues [Ref. 8].

Discrete event simulation is frequently used to model military supply depot operations. The use of discrete event simulation as a forecasting tool offers several advantages to logistics planners. Queue statistics gathered during the simulation pinpoint processing bottlenecks that may be expected to occur. Server utilization statistics collected for each functional area may be used to support resource allocation decisions. System throughput data can be quantified by measuring the processing time for the different classes of requisitions passing through the system. In addition, the model may be easily modified to reflect increasing levels of demand, changes in net effectiveness or the addition of personnel.

C. SIMULATION LANGUAGES

Discrete event simulation programs may be written in a general purpose programming language like FORTRAN or PASCAL, or in a special purpose simulation language. As computer simulation evolved as an operations research technique in the late 1950s, all simulations were written in general purpose or specific-machine languages. As researchers began to recognize the fact that many situations being simulated were composed of functionally similar processes, the need to develop special purpose languages in which single operators would perform common functions became apparent. Emshoff and Sisson [Ref. 9: p. 116] enumerated the functions common to all simulations that distinguish simulation languages from general purpose programming languages:

1. create random numbers
2. create random variates
3. advance time, either by one unit or to the next event
4. record data for output
5. perform statistical analyses on recorded data
6. arrange outputs in specified formats
7. detect and report logical inconsistencies and other error conditions

Kiviat [Ref. 10] cited programming convenience and concept articulation as the two major advantages of using a simulation language as opposed to a general purpose language.

Concept articulation refers to the ability of simulation languages to communicate the structure of a system being modeled through the use of a descriptive vocabulary. This is especially important to analysts in the model development phase. It also improves communication in that simulations are more easily explained to management and other non-programming oriented users.

The programming convenience of simulation languages is evidenced by the reduction in both program length and development effort required. Jennergren [Ref. 11] concluded that simulation programs written in PASCAL average twice the length of their simulation language counterparts. Emshoff and Sisson [Ref. 9: p. 117] estimate the savings in model development effort resulting from the use of simulation languages to be on the order of a factor of 10. Several factors contribute to the programming convenience of simulation languages. The subroutines provided as standard features of simulation languages provide programmers with simple tools to represent simulation-unique functions and concepts. The ease with which simulation languages define classes of system entities, differentiate among entities within those classes and permit adjustment of the number or type of entities in the system is also helpful. The convenience of simulation languages is not achieved without sacrifice. The structuring of entities and activities in simulation languages increases their flexibility in that changes to the system require only simple modifications to the program. These generalized structures, however, limit the ability of simulation languages to represent system detail. Though simulation languages automatically collect and display data generally desired by analysts, they are less flexible than general purpose programming languages with respect to the variety of output formats. Finally, programs written in simulation languages can expect to experience slower execution times than general purpose language programs.

The initial concern of most organizations in the process of selecting a simulation language is ensuring that the chosen language is compatible with installed hardware and that its use is within the capability of the organization's analysts. Other questions should be answered in the second phase of the selection process. The relative ease of learning, availability of users manuals, machine portability, quality of error diagnostics, language efficiency and cost of the languages under consideration should be explored. Finally, the ability of the chosen simulation language to naturally describe the system in question should be studied. The suitability of a simulation language to a given problem may be assessed by examining its "world view."

The world view of a simulation language is the way that it conceptualizes the entities of a system, the attributes that further describe those entities, and the interaction between those entities and the activities of the system [Ref. 12: p. 17]. World views of simulation are grouped into two schools of simulation thought, one emphasizing the use of flowcharts to describe models, the other relying on program statements.

Flowchart languages are regarded by users as somewhat easier to learn and interpret, while statement oriented languages are more flexible [Ref. 12: p. 18]. Statement oriented languages are characterized by three world views--activity, event and process. Flowchart oriented simulation languages adhere to the transaction world view. The transaction world view models systems by tracing the flow of transactions through specialized activity blocks. Simulated time advances as transactions pass through the blocks which are used to represent actual processes or real system decisions. Users familiar with flowcharting techniques and the system being modeled find the transaction view convenient to use and easy to learn. IBM's GPSS is the predominant language in this category.

D. GPSS

The transaction world view of GPSS is structurally similar to the complex queuing problems posed by requisition flow in a supply depot. GPSS uses block diagrams to visualize transactions moving from process to process within the system. Each GPSS block is implemented by a code segment representing an action relative to the system simulation. The close relationship between the block diagram and program code to the logical structure of the system being simulated makes GPSS easy to use. System throughput, resource utilization and queuing statistics collected as standard features of GPSS may be tailored to support the information requirements of the logistics planner.

GPSS is particularly attractive to the inexperienced user. The block diagram structure reduces the complexity of model development and communicates an understanding of the simulation program to users. Statistics gathering and display require minimal effort on the part of the user. Because GPSS is the most popular and widely used simulation language [Ref. 13], numerous companies market GPSS products and provide comprehensive documentation. In addition several academic texts on GPSS have been published, offering another source of information to users.

Minuteman Software has developed a microcomputer version of GPSS, marketed under the name of GPSS/PC, to take advantage of the increased CPU and memory capacities of modern microcomputers. Designed for use on IBM compatible microcomputers, the structure and syntax of GPSS/PC are nearly identical to that of the mainframe version, enabling it to retain its attractiveness as a discrete event simulation language. The primary advantages of using a simulation language designed for the microcomputer are reduced software expenses and the convenience to the analyst of working on a dedicated microcomputer. While the general design of GPSS/PC is suited to the simulation of supply depot operations, it is constrained by its inability to to address more than 640 kilobytes of random access memory, a limit shared by all applications programs running on IBM's Disk Operating System (DOS). Due to this inherited limitation, GPSS/PC is not useful in the simulation of large queuing systems such as NSD Yokosuka.

Discrete event simulation, utilizing GPSS, could be effectively used to support logistics planning efforts of NSD Yokosuka. Note the following points:

1. Issue processing procedures at NSD Yokosuka are permeated with the type of queuing phenomena that discrete event simulation languages, GPSS in particular, are designed to model.
2. The standard format of discrete simulation output is suited to the information requirements of Depot planners.
3. Experimentation, including minor modifications, with existing simulation models is within the capability of analysts in the NSD Yokosuka Planning Division.
4. The block diagram structure of GPSS improves user understanding of program structure, easing the process of making program modifications required by changes in NSD facilities or procedures.
5. Owing to its popularity, GPSS documentation, training, and technical assistance are all readily available to the NSD

While discrete event simulation can be a useful tool to logistics planners, its disadvantages must also be recognized. Drawbacks to the use of computer simulation in logistics planning include:

1. Validating a simulation model requires substantial effort and is a continuing process as the model must be maintained to reflect real system changes. If the basic model does not accurately reflect actual system operations or supporting data is erroneous, simulation results will not be useful.
2. Though experimentation and minor modifications are within the capability of NSD Yokosuka personnel, major revision would require outside training or assistance.
3. Because the simulation model is a simplification of the actual system, detail useful to planners is lost. In addition, limiting the scope of the model leaves planners without information on other essential Depot functions.

The practical limitations of discrete event simulation must be accepted before it is employed as a logistics planning tool. In combination with other operations research techniques, discrete event simulation using GPSS can be an effective method of forecasting NSD Yokosuka performance under conditions of surge demand.

III. THE SYSTEM TO BE MODELED

NSD Yokosuka's main administrative offices and storage facilities are located on U. S. Naval Base Yokosuka, of which the NSD is a tenant activity. Figure 3.1 shows the physical layout of NSD facilities on Naval Base Yokosuka. Yokohama Cold Storage, located approximately 20 miles from Yokosuka, is the only modeled activity of the NSD not located within the confines of Naval Base Yokosuka.

NSD Yokosuka has 54 U. S. Civil Service and 905 Japanese National employees in addition to the 176 military personnel authorized. Normal working hours are 0800 to 1645 Monday through Friday with a 45 minute lunch break. Non-duty hour processing of issue priority group one (IPG1) requisitions and IPG2 bearer walkthrough and Casualty Reporting System (CASREPT) requisitions is handled by the duty section on weekends and by the Customer Services Division evening and midnight shifts during the week. DPSC maintains seven day a week, around-the-clock computer center operations in support of issue processing.

The Depot receives an average of 43,000 requisitions a month, of which approximately 90% are for standard stock items. Of the total demand for standard stock items, NSD Yokosuka typically makes 30,000 issues per month from its $43,000,000 inventory of over 78,000 line items. 75% of those issues are for material stored in the general storage locations of the Depot. The remaining 25% are for provisions stored in Yokosuka Cold Storage (Building 1390), Yokosuka Dry Storage (B-47) and Yokohama Cold Storage.

Figure 3.2 is a basic flow diagram of NSD Yokosuka issue operations. Requisition input to the system arrives in two forms, hard copy or online. Online requisitions are received via Automatic Digital Network (AUTODIN), Disk

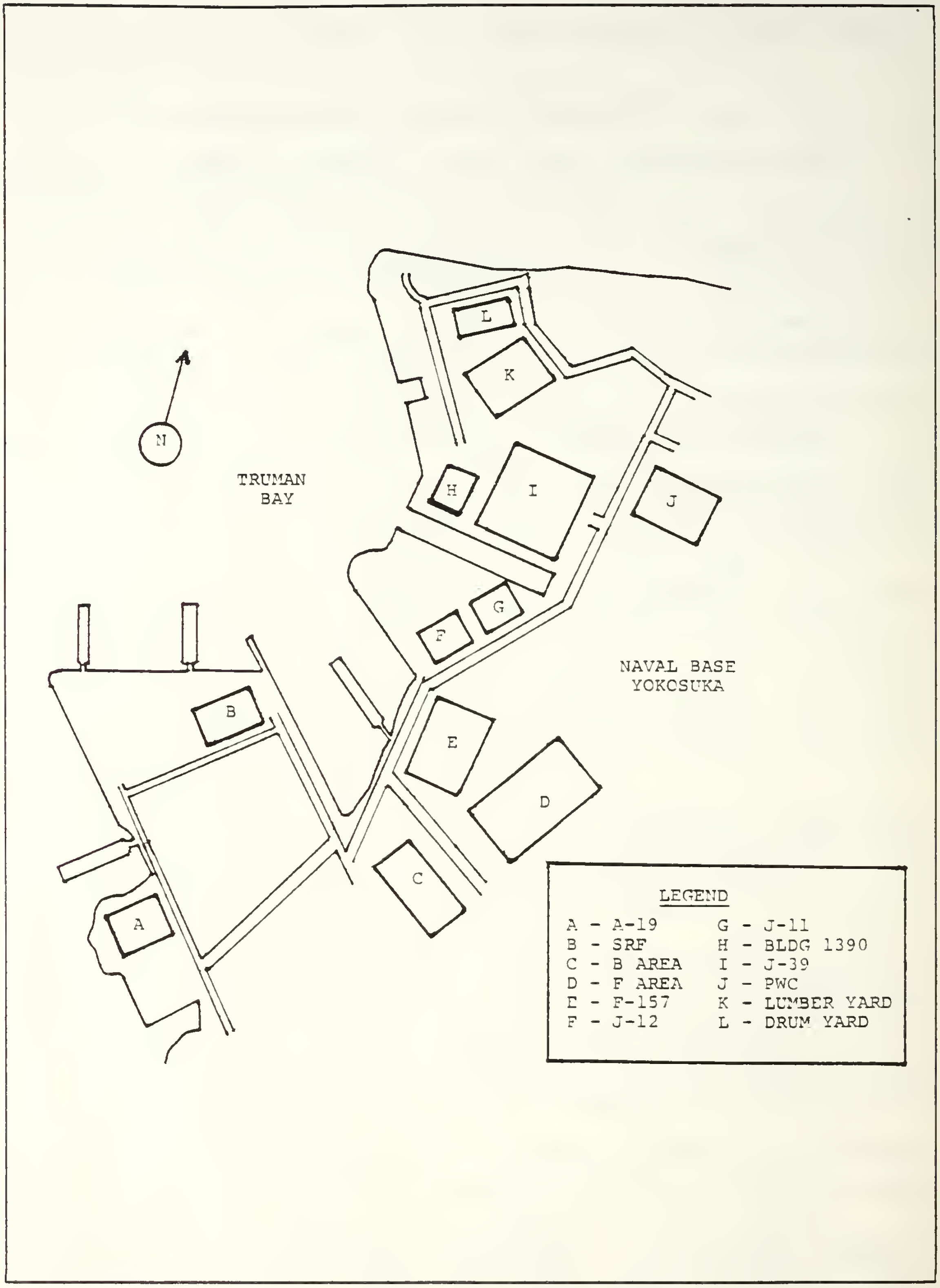

Figure 3.1 Physical Layout.

Oriented Supply System (DOSS) and local customer remote terminal entry. The requirements of activities without installed remote terminal entry equipment and all perishable provisions (9MP/9MB), ships store stock (1Q) and bearer requisitions are received in hard copy form. Requisitions for 9MP, 9MB and 1Q material are initially routed to the Requirements Division for stock check. IPG1 requisitions, IPG2 bearer walkthrough, CASREPT and quick pick requisitions and all 9MP, 9MB and 1Q requisitions (regardless of priority) received by NSD are entered via remote terminal in Customer Services. All other requisitions are transferred to DPSC for entry. Requisitions are handled throughout the Depot on a first come, first served, within priority level basis. Priority levels, from highest to lowest, are as follows:

1. IPG1 bearer walkthrough all other IPG1
2. IPG2 bearer walkthrough
3. IPG2 CASREPT (not bearer walkthrough)
4. IPG2 quick pick
5. all other IPG2
6. all IPG3

Regardless of their origin, all IPG1, CASREPT, bearer walkthrough, quick pick, dry provisions (9MF) and 1Q requisitions wait in a queue file to be processed by Uniform Automated Data Processing System (UADPS) programs UC02 and UC96. The queue file is emptied frequently (every 5 minutes) into UC02/UC96 for processing. Issue documents for material determined to be in stock are output immediately in Customer Services. 9MP and 9MB requisitions are entered under local procedures and issue documents are printed on the Customer Services printer. The balance of IPG2 and all IPG3 requisitions are processed in batch mode by UC02/UC96 and local programs LC06, LC07 and LC08. Issue documents for material determined to be in stock are output in Storage Control.

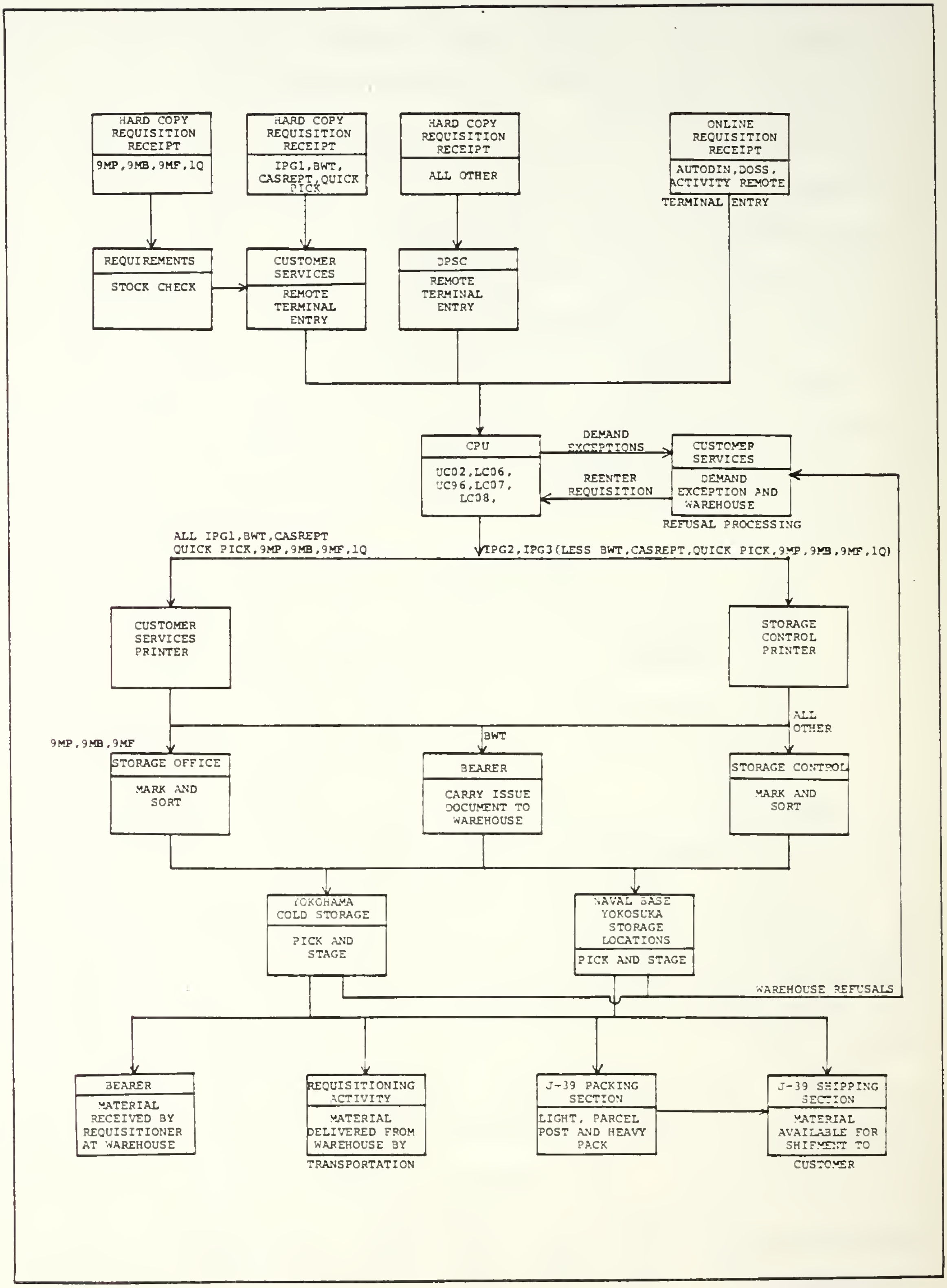
HARD COPY REQUISITION RECEIPT
9MP,9MB,9MF,1Q
HARD COPY REQUISITION RECEIPT
IPG1,BWT, CASREPT,QUICK PICK
HARD COPY REQUISITION RECEIPT
ALL OTHER
ONLINE REQUISITION RECEIPT
AUTODIN,DOSS, ACTIVITY REMOTE TERMINAL ENTRY
REQUIREMENTS
STOCK CHECK
CUSTOMER SERVICES
REMOTE TERMINAL ENTRY
DPSC
REMOTE TERMINAL ENTRY
CPU
UC02,LC06, UC96,LC07, LC08,
DEMAND EXCEPTIONS
REENTER REQUISITION
CUSTOMER SERVICES
DEMAND EXCEPTION AND WAREHOUSE REFUSAL PROCESSING
ALL IPG1,BWT,CASREPT QUICK PICK,9MP,9MB,9MF,1Q
IPG2,IPG3(LESS BWT,CASREPT,QUICK PICK,9MP,9MB,9MF,1Q)
CUSTOMER SERVICES PRINTER
STORAGE CONTROL PRINTER
ALL OTHER
9MP,9MB,9MF
BWT
STORAGE OFFICE
MARK AND SORT
BEARER
CARRY ISSUE DOCUMENT TO WAREHOUSE
STORAGE CONTROL
MARK AND SORT
YOKOHAMA COLD STORAGE
PICK AND STAGE
NAVAL BASE YOKOSUKA STORAGE LOCATIONS
PICK AND STAGE
WAREHOUSE REFUSALS
BEARER
MATERIAL RECEIVED BY REQUISITIONER AT WAREHOUSE
REQUISITIONING ACTIVITY
MATERIAL DELIVERED FROM WAREHOUSE BY TRANSPORTATION
J-39 PACKING SECTION
LIGHT, PARCEL POST AND HEAVY PACK
J-39 SHIPPING SECTION
MATERIAL AVAILABLE FOR SHIPMENT TO CUSTOMER

Figure 3.2 Flow Diagram.

Issue documents for provisions are output in Customer Services. Demand exceptions are reviewed by exception clerks in Customer Services and re-entered into the system.

All issue documents printed in Customer Services are annotated or stamped as appropriate (quick pick, CASREPT, etc.) and are routed for further processing. Provisions issue documents are delivered to the Storage Office. Issue documents produced for bearer walkthrough requisitions are released to the bearer to be hand carried to the warehouse storing the material. All other issue documents are delivered to Storage Control.

Storage Control personnel sort those issue documents printed by the Storage Control printer and those received from Customer Services by warehouse and deliver the document batches by bicycle messenger to their respective storage locations. Provisions documents received in the Storage Office are also sorted by storage location. Issue documents for provisions in Building 1390 and B-47 are delivered by the bicycle messenger. Issue documents for perishable provisions stocked in Yokohama are delivered by a truck that leaves Yokosuka at 0900 on workdays, arriving in Yokohama later the same morning.

Upon receipt of issue documents, warehouse personnel pick the requisitioned material, attach copies of the issue document, and segregate it by destination. In general storage locations, material is staged separately for delivery to the Publics Works Center (PWC), the Ship Repair Facility (SRF) and the Packing and Shipping Sections of the Freight Terminal. In provisions warehouses, the majority of material is staged within the facility to be delivered directly to the requisitioner. Provisions issues for off-base delivery or bearer pick-up are staged separately. All bearer issues are turned over to the customer at the warehouse. Warehouse refusals are annotated as such on issue documents which are returned to Customer Services for processing (i.e. investigation, transaction reversal, referal or cancellation).

Material segregated for delivery in general storage locations to PWC, SRF, or the Freight Terminal is transported by Labor and Equipment Division tractor trains to its next destination. Tractor trains run on two separate routes at 0815, 1015,1300 and 1400 on workdays. Material requisitioned by PWC and SRF is delivered enroute to Building J-39. All material requiring packing prior to shipment is unloaded in the Packing Section of J-39. The remaining material is delivered to the Shipping Section. Tractor trains run on an as required basis to deliver provisions from B-47 and Building 1390 to the Freight Terminal.

Material transported to the Packing Section is packaged for further transportation to the customer. Three basic types of pack are used--light, parcel post or heavy--as appropriate to the material. When packing is completed the material is delivered to the Shipping Section, adjacent to the end of the packing line, for further processing.

The Uniform Material Movement and Issue Priority System (UMMIPS) treats issues received in the Shipping Section as available for shipment to the requisitioner and issue processing statistics maintained by the Depot do not record handling time in the Shipping Section. Shipping Section operations, beyond receipt of material, are not modeled in the simulation program.

IV. THE MODEL

A. DEFINITION

The computer program is written in IBM's GPSS V. The program simulates all NSD Yokosuka functions that directly support issue processing operations, from requisition receipt to the point of availability of the issue for shipment to the requisitioner. Specific functions simulated are:

1. Requirements Division stock check of perishable provision and ships store stock requisitions.
2. Customer Services and DPSC remote terminal entry of hard copy requisitions.
3. Customer Services demand exception and warehouse refusal processing
4. Customer Services and Storage Control issue document printer operations
5. Storage Control and Storage Office sorting and handling of issue documents
6. Delivery of issue documents to Yokohama Cold Storage and Naval Base Yokosuka storage locations
7. Warehouse pick and stage operations (and shipment preparations in provisions storage locations)
8. Tractor train delivery of issues to SRF, PWC and the packing and shipping sections of the Freight Terminal
9. Packing operations
10. Duty section and late shift operations

A copy of the program code is provided as Appendix A. Listings of program variables, functions, transaction parameters and storages referenced during the simulation are all included in the program code. A GPSS block diagram of the program structure is provided as Appendix B. The succeeding section refers to segments of the GPSS block diagram to relate the structure of the simulation program to actual Depot operations.

B. STRUCTURE

GPSS simulates actual system performance by generating requisitions (referred to as transactions) at time intervals modeled after real system arrivals and permitting the generated transactions to proceed through block paths representing real system processes. Each GPSS block executes a subroutine which may delay, modify, remove or control the flow of the entering transaction. In a large system composed of separate workcenters, such as NSD Yokosuka, transactions move through a varied series of processes before an issue results. Although these processes differ physically, many are logically similar (e.g., transactions enter a workcenter, wait for service, are processed and then leave the workcenter for the next processing step). Consequently, GPSS is able to simulate a wide variety of processes with a relatively small vocabulary of blocks.

GPSS can also generate control transactions in separate modules to alter system status (i.e., control storage availability, trigger scheduled events). The generation of control transactions and their flow through the program blocks is timed to coincide with operating schedules of the Depot. Time is divided into units of .01 hours in the simulation. The reader is therefore reminded to carefully interpret simulation time in the program (i.e., 30 minutes is represented as 50, 8 hours and 45 minutes as 875, etc.).

This section of the chapter groups logically similar processes into categories and references modules in the GPSS block diagram in Appendix B to demonstrate how actual processes are modeled in the program. All GPSS blocks discussed in this section appear in upper case to set them apart from the text. Assumptions made in modeling the real system processes are presented as are special programming details that may not be apparent to the user. An understanding of this section will improve the reader's comprehension of the program code. It will also serve to assist the user in making program changes for the purpose of system experimentation or reflecting real system changes.

1. Requisition Generation

Requisition generation and priority assignment is modeled in the requisition generation module of the program. GPSS V limits each model to 32,767 concurrently active transactions. To remain within that limitation during simulation experiments, the number of transactions generated has been reduced by structuring the program to permit a single transaction to represent three requisitions. All succeeding program modules, with the exception of the duty section module, process each transaction as if it were 3 separate requisitions to maintain an operational pace equivalent to actual Depot operations.

The number of demands generated in one week of simulated time is computed by multiplying the monthly demand level input by the user by a factor of .231 (based on an average of 4.33 weeks per month). The daily distribution of those demands is determined by function FTHNN which is derived from daily demand data supplied by the NSD. The daily demand level is then divided by 3 to obtain the number of transactions generated during each simulated day.

Daily requisition arrival rates utilized in the simulation are constant over the weekend, but are computed to force generation of 89% of weekday demands during normal operating hours, consistent with the pattern of workday requisition arrivals actually experienced by the Depot. As data supporting an alternative distribution of requisition arrivals is not available at this time, transactions are allowed to proceed into the model at a uniform rate. Although the clumping of requisition arrivals expected during actual operation is not duplicated, requisition flow similar to that experienced by the NSD is restored early in the requisition processing cycle by the simulation of the batch printing of issues documents in the printer queue handling module.

The first three requisition generation subsections of the requisition generation module are responsible for generating requisitions on weekdays--before, during and after normal operating hours respectively. The fourth requisition generation subsection generates weekend arrivals. The GENERATE block in each subsection creates a single transaction each simulated day at the beginning of its assigned time period (i.e., 0001 for the AM subsection, 0800 for the operating hours subsection). Because all of the requisition generation subsections create a single transaction each day of the week, transactions generated in the weekday generation subsections must be terminated on weekends and transactions generated in the weekend generation subsection must be terminated on weekdays. The TEST blocks permits the generated transaction to proceed on workdays in the first three subsections and on weekends in the last subsection. Transactions failing that test are transferred to the TERMINATE block labeled RQTRM and removed from the model.

All transactions that are not terminated continue through the requisition generation subsections. The SPLIT and ADVANCE blocks combine to transform the previously generated single transactions into a uniform flow of transactions representing the arrival of requisitions at the NSD. Transactions entering the SPLIT block are split into the number of transactions expected during the period. The ADVANCE block then permits the newly created transactions to pass to the next block at a uniform rate, where they are transferred to the ASSIGN block PRIAS. The ASSIGN block references function FONE and stochastically assigns an integer value representing requisition priority to parameter 1 of each transaction. The following PRIORITY block copies the parameter 1 value to assign transaction priorities referenced during program execution to determine processing order. All transactions are then routed by their parameter 1 value through a path of SAVEVALUE blocks that serve as requisition counters.

2. Work Scheduling

Operating schedules for Depot workcenters during the normal workday, the late shift and duty section, the issue document printers and the tractor trains are all managed by control transactions in schedule control sections. With the exception of normal workday scheduling, which is controlled in separate modules, all schedule control sections are located in the module whose operations they control.

As an example of how work scheduling is managed by the program, the schedule control section of the duty section module is explained below. The first block in the section generates a control transaction at the beginning of each day. On weekdays the control transaction proceeds through the module, alternately entering ADVANCE blocks to simulate the passage of time and UNLINK blocks positioned to coordinate the flow of transactions with the operating status of the duty section. After 1675 time units have passed, marking the end of the normal workday at 1645, the control transaction is terminated and the process is repeated at the beginning of the next simulated day. On weekends the control transaction is routed directly to the TERMINATE block labeled DTEND and removed from the model, permitting the duty section to remain in continuous operation over the weekend. Scheduling of the issue document printer and tractor train operations differ only in that control transactions are created at more frequent intervals during the day to trigger the repetitively scheduled processes.

3. Workcenter Operations

NSD workcenters supporting issue processing operations are represented throughout the program as storages. A storage is an entity provided by GPSS to simulate homogenous parallel servers, that is, personnel working side by side performing similar duties at similar rates of speed. Each storage referenced in the simulation is included in the storage definition section where its symbolic name, capacity and description is provided. Storages that have been thus defined may then be referenced in the program to simulate the actual processing of requisitions.

SKCK is the symbolic name of the storage referenced by the requisition receipt module. It simulates the stock check of perishable provision and ships store stock requisitions in the Requirements Division and has a defined capacity of two personnel. Storage references are commonly accompanied by two block pairs, QUEUE/DEPART and ENTER/LEAVE. The function of the QUEUE and DEPART blocks is to collect statistics regarding the time spent by transactions waiting for the storage to become available and related queue data. The ENTER and LEAVE blocks perform the function of controlling access to the ADVANCE block, limiting its current contents to the defined capacity of the storage. After a simulation is run, statistics detailing the time spent waiting for service and the active processing time at each defined storage are presented. See Chapter V for a more detailed description of output statistics.

The time that it takes to process a single transaction in the Requirements Division is simulated in the ADVANCE block labeled SKCK. The ADVANCE block delays each transaction for an explicit period of time equal to the value of the variable V$SKCKS named in the A operand. In recognition of the fact that each transaction represents 3 requisitions, the service times used in the model are computed by summing 3 individual service times. Individual service times are drawn from functions containing frequency distributions of service times observed during actual operations at NSD Yokosuka. The service times of workcenters for which frequency distributions were not available to the author are computed from mean service times provided by NSD and are assumed to follow the negative exponential distribution. These included all provisions storage locations and the main warehouse (F-157). Mean service times were also used for all Requirements Division, Customer Services Division, Storage Office and Storage Control requisition and issue document handling processes due to the brief and uniform nature of those functions. Mean service times were not available for packing operations, so Packing Section service times employed in the model were computed by dividing the manhours recorded for each pack type on the NSD Yokosuka Uniform Management Reports by the number of issues packed.

4. Requisition Flow Control

Most modules modeling workcenter operations begin with flow control sections that serve two primary purposes. First, program execution efficiency is improved by placing transactions that are about to attempt entry into a storage on a "user chain" until the storage has available capacity. Managing waiting transactions in this manner frees the computer from continuously scanning each transaction attempting to enter a storage. Secondly, the unlinking of transactions from user chains at the end of the workday provides positive control of high priority requisitions that require transfer to the duty section module for processing after normal operating hours.

Though flow control sections in the program differ slightly in structure, the flow control section in the Requirements Division module is representative of the basic structure employed throughout the program. The first three TEST blocks following SKCKQ route transactions that have joined the queue. Transactions entering during lunch are transferred to the LINK block labeled SKCKL where they are placed on the user chain SKCKC. Transactions entering outside of the normal workday are transferred to the TEST block SKCKT which routes transactions based on their priority. High priority transactions (those handled by the duty section) are assigned a progress indicator in parameter 3 that marks their stage in processing. They are then removed from the QSKCK queue and are transferred to the duty section module for processing. Low priority requisitions (those not handled by the duty section) are transferred to the advance block labeled SKCKA where they are delayed a single time unit to avoid an endless loop of linking and unlinking. The transactions are then transferred to SKCKL and placed on user chain SKCKC. Those transactions arriving during normal operating hours proceed directly to the ENTER block labeled SKCKE if the storage SKCK has remaining capacity. Otherwise, the transactions are transferred to SKCKL and placed on user chain SKCKC. Those entering during working hours when the storage has no available capacity proceed to the LINK block labeled SKCKL where they are placed on user chain SKCKC.

During normal operating hours one transaction is unlinked from the user chain to enter the storage for each transaction leaving the storage, maintaining full utilization of the storage as long as transactions remain on the user chain. All transactions are unlinked from user chain SKCKC at the end of the workday by a control transaction in the schedule control module so that high priority transactions residing on the user chain may be identified and routed to the duty section module. Low priority requisitions are relinked to user chain SKCKC to await processing during the next scheduled workday.

5. Printer Operations

The NSD Yokosuka issue document printers are currently located in DPSC and Customer Services. However, the modeling of printer operations in the program reflects NSD Yokosuka plans to relocate the DPSC printer to Storage Control in Fiscal Year 1986.

Customer Services printer operations including the schedule control section are modeled in the printer queue handling module. IPG1, IPG2 (CASREPT, quick pick and bearer walkthrough) and all provisions transactions are routed to the block labeled CSPRQ and placed in the QCSPR queue. The LINK block places all transactions on user chain ONE. The transactions are released at simulated time intervals of 5 minutes by the UNLINK block labeled UNLNK in the schedule control section, matching queue file processing procedures followed by UC02/UC96. The "printed" transactions are removed from the QCSPR queue by the DEPART block. They proceed through ENTER and LEAVE blocks referencing the CSPR storage without an intervening advance block because the processing delay actually experienced by requisitions waiting for UC96/UC02 to empty the queue file is simulated by the delay on the user chain.

6. Transportation Operations

Issue processing functions of the Depot include the transportation of issue documents and material between stationary workcenters. The programming technique used to simulate transportation processes involves linking transactions to user chains and using control transactions generated in corresponding schedule control sections to unlink them to succeeding modules. Transportation processes that, in actual operations, are essentially without maximum capacities are modeled as such (e.g., the number of issue documents that may be transported to Yokohama Cold Storage during a single delivery run is essentially unlimited).

Modeling transportation processes with known capacities is more complex.

Operations of the "B" route tractor train are simulated in the tractor train delivery module. Control transactions are created in the schedule control section at simulated times corresponding to the actual train schedule and are transferred to the UNLINK block LOADB on workdays. The loading of IPG1 and IPG2 transactions on the tractor train is managed by LOADB and the succeeding UNLINK blocks in the loading section which release all transactions on the JCF, BCH and ACH user chains to the test block BTEST in the operations section.

The operations section controls transaction access to the tractor trains. BTEST permits IPG1 and IPG2 transactions to proceed to the following TEST block. The weight of each transaction is then checked to ensure that it does not exceed the remaining capacity of the storage BTRN. Transactions meeting that test are transferred to BTRNE to enter the storage (i.e. are loaded on the train), depart QBTRN in the following block and are linked to user chain BTRNC in the succeeding LINK block. All IPG3 transactions and those transactions whose weight exceeds the remaining capacity of the storage (signifying that the train has been loaded to capacity) pass through the following ADVANCE block and are transferred back to their respective warehouse module to await the next train. By screening IPG1 and IPG2 transactions in advance of the normal loading cycle, IPG3 transactions at the first tractor train stop are prevented from effectively denying transportation to IPG1 and IPG2 transactions at later stops. This is consistent with tractor train loading procedures of NSD Yokosuka.

The succeeding blocks in the loading section govern the loading of IPG3 transactions returned to the warehouse. The control transaction passes through an ADVANCE block which delays it to simulate movement of the tractor train from J-39 to its first stop, J warehouse area. The following UNLINK block releases, in priority order, all transactions waiting on user chain JCH to the TEST block BTRNT. The unlinked transactions are then loaded on the tractor train, capacity permitting, in the manner described by the previous paragraph. The control transaction continues through alternating ADVANCE and UNLINK blocks to repeat this process for transactions waiting at warehouse areas A and B.

After linking waiting transactions to the user chain BTRNC, the control transaction in the loading section enters an ADVANCE block which delays it to simulate movement of the train to the first unloading points, PWC and SRF. When the control transaction enters the succeeding UNLINK block, all transactions on the user chain BTRNC leave the storage BTRN and proceed to the TEST block TMTST. Transactions with a parameter 4 value indicating delivery to PWC and SRF are transferred for termination simulating delivery to requisitioner. All other transactions are delayed by an ADVANCE block to simulate transportation to the Freight Terminal.

7. Duty Section Operations

The flow control sections throughout the program are designed to forward IPG1 and IPG2 CASREPT and bearer walkthrough transactions to the duty section module at the end of the workday and on weekends. Processing steps in the duty section module are similar to normal workday procedures except that all transactions are stock checked before remote terminal entry and transportation delays are modeled to recognize the fact that requisitions handled by the duty section are processed continuously from receipt to issue. Additionally, all 9MP and 9MB issues are made from Building 1390, as nearly all after hours provisions issues made by NSD Yokosuka are for requisitions received from inport ships.

So that transportation delays due to single issue processing by the duty section are accurately modeled, each transaction (representing three requisitions at this point) entering the storage DUTY is split into three identical transactions, each representing a single requisition. The number of transactions that may be simultaneously processed in the duty section module is limited to the duty section storage capacity of 2 which is consistent with the number of personnel actually available in the late shifts and duty section to handle issues.

The storage DUTY is unique in that it has several ADVANCE blocks between the ENTER and LEAVE blocks, each representing a step in actual issue processing. The first block in the operations section joins all transactions to the queue DUTYQ. The succeeding TEST blocks send entering transactions directly to the block labeled DUTYS if the storage DUTY has available capacity. Those entering before 1646 on workdays or when the storage is full are linked to the user chain DUTYC to await processing.

Transactions transferred directly, as well as those unlinked from user chain DUTYC for processing, proceed to the SPLIT block labeled DUTYS. There, each transaction is split into 3 separate transactions, each representing a single requisition as previously explained. The following TRANSFER block sends the original transaction directly to the ENTER block DUTYE. The newly created transactions are first transferred to QSPLT to be joined to DUTYQ before proceeding to the ENTER block. Transactions proceed beyond the ENTER block as the defined capacity of DUTY permits. They are removed from DUTYQ in the next block and then transferred to the starting point in the duty section module appropriate to the progress indicator stored in parameter 3.

The complete processing of each transaction is then simulated as the transaction passes through the remainder of the module blocks. When processing is completed, each transaction passes through the dummy ADVANCE block labeled DUTTR, placed to provide a count of leaving transactions that is referenced by the following TEST block. The TEST block allows every third transaction to pass through the next block which unlinks a single transaction (representing 3 requisitions) to DUTYS. The above process is then repeated for the unlinked transaction.

The TRANSFER block SEND transfers transactions that complete processing in the duty section module to termination blocks appropriate to each transaction. At the start of the following workday, any unprocessed transactions remaining on the user chain DUTYC are unlinked to DUTYD by a control transaction in the schedule section. Those transactions are removed from DUTYQ and transferred back to their point of origin indicated by parameter 3. The processing of all transactions that have been split into individual requisitions is completed in the duty section module.

V. VERIFICATION AND VALIDATION

A. INTRODUCTION

This chapter will review verification of the program structure and discuss procedures to be used in the validation of simulation results. Verification and validation are terms used to describe the process of establishing the credibility of simulation models. The verification process entails ensuring that the logic of the computer program corresponds to that of the real system. Validation takes the process a step further, by testing the model to determine if it reasonably reflects real system processes.

Program output used during verification and validation is produced at the end of the simulation. The output is divided into 4 "snapshots" presenting a set of cumulative statistics at the end of each simulated week. The final snapshot of the program output used to verify this model is provided as Appendix C. The sections listed below are of particular interest:

1. Queue statistics
2. Storage statistics
3. Savevalues--total requisition generation count (REQCT), requisition generation count by issue priority group (PRONE, PRTWO and PRTHR), NIS requisition count (NISCT), warehouse refusal count (WRCT) and tractor train run count (ANUM, BNUM and PNUM)
4. Tables--throughput time distribution for all issues (ALL) and throughput time distribution for issues by issue priority group (IPGON, IPGTW, IPGTH)
5. Block counts

Storage statistics provide information regarding the active processing time experienced by transactions (requisitions) during the simulation as well storage (workcenter) utilization information. For each storage defined in the model, GPSS provides standard output that can be used to study system performance. Storage names and capacities are provided under the corresponding headings. The total number of transactions processed during the simulation may be found in the column labeled "ENTRIES." The average processing time for those transactions that have been processed should closely approximate the mean of the service time data supplied to the program and may be verified by examining data in the column headed "AVERAGE TIME/UNIT". Statistics measuring storage utilization during operating hours are of particular interest to the user. The percentage of time that a storage is available for normal operations is given in the column "PERCENT AVAILABILITY" (e.g., the storage SKCK available 23.8% of the time or .238 X 168 hours = 40 hours per week). During this period of availability, average utilization may be found under the "AVAIL. TIME" heading. For the storage SKCK, this value was .135 or 13.5%

Queue statistics detail the waiting times experienced by transactions attempting to enter storages in the model. They are provided immediately following storage statistics in a similar format. The maximum, average and total number of requisitions awaiting processing in each of the queues listed in the first column are provided in the next three columns. The column headed "AVERAGE TIME/TRANS" provides the average time spent waiting for processing by all transactions joining the queue. This information is used to isolate delays in transaction processing and is particularly useful during experimentation in identifying system "bottlenecks."

Savevalues are employed as "counters" during the simulation. Savevalues tally the total number of transactions entering the system and provide subtotals by issue priority groups. They are also used to count NIS and warehouse refusal transactions experienced during the simulation. During validation, the output values for savevalues defined in the program may be compared to input parameters to verify the demand level and mix, acting as a yardstick for evaluating system performance.

Tables defined in the program are designed to provide system throughput data that may be compared to Uniform Material Movement and Issue Priority System (UMMIPS) statistics maintained by the Depot. Tabulate blocks are positioned in the termination module to collect statistics at the point of issue or availability for shipment. The system entry time of each transaction entering a TABULATE block is subtracted from the current simulation clock time, recording the difference as the total issue processing time. The elapsed processing times of all transactions representing issues are aggregated and presented as a frequency distribution table.

The first row of data in each table presents the total number of transactions tabulated, the mean throughput time and the standard deviation. In the body of the frequency distribution table, the data is grouped into predefined intervals whose upper limits are listed in the first column. Because simulated time in the model is based on units of .01 hours, the listed upper limits must be divided by 100 to obtain the correct time in hours. The frequency of occurrence, percentage of total occurrences and cumulative percentage of occurrences in each interval are presented in the next three columns. As in the savevalue output section, one table is used to tabulate all transactions leaving the system and three separate tables present tabulations for the three issue priority groups.

While the block count section of the program does not provide useful information during the validation phase, it is a valuable tool during verification to review transaction flow. A current and total transaction count is provided for each block in the program. This data can be compared to corresponding block operands, especially flow control blocks like TEST or TRANSFER, to ensure that program logic is consistent with real system operations.

B. VERIFICATION

Steps in the verification phase are designed to expose coding and logic errors. Transaction generation and flow are reviewed using block count and savevalue statistics to verify that the characteristics of requisition flow at NSD Yokosuka is duplicated by the simulation model. The verification phase was completed using the final snapshot in the output listing provided by Appendix C.

The savevalue REQCT counted 39,780 transactions entering the model during the four weeks of simulated operations conducted at a monthly demand level of 43,00 requisitions. Assuming 4.33 weeks to the month, the entry of 39,692 transactions ((43,000/4.33) X 4 weeks) would have been expected. The difference between the requisition receipt rate experienced from that expected is due to truncation during GPSS variable computation and may be compensated for by slightly increasing the demand level.

The characteristics of transactions entering the system were also reviewed. Block counts of the SPLIT blocks in the workday requisition generation subsections were used to compute the percentage of transactions entering during the normal operating hours of the workday. 89% of all workday transactions entered the model during the simulated time period of 0800 - 1645, matching the pattern of real system arrivals. Priority assignment recorded by the savevalues PRION, PRITW and PRITH were compared to the priority assignment input data in function FONE. The recorded number of transactions in each priority group matched expected results.

Requisition flow points representing the routing of online requisitions, perishable provisions requisitions stock checked in Requirements Division, demand exceptions, NIS requisitions and warehouse refusals were all verified by reviewing block count statistics. All observed counts differed from expected values by less than 1% with the exception of the warehouse refusal count. The difference in warehouse refusals observed from the number expected was 4% and is attributed to the smaller sample size of 67 warehouse refusals.

Warehouse location assignment in the model is handled by the ASSIGN block labeled LOCAS in the warehouse assignment module. A temporary TABULATE block was inserted following LOCAS to determine and verify the assignments to each warehouse area. Observed differences from expected assignments ranged from .01% to 13%. Fluctuations in warehouse arrivals of this magnitude are exceeded by those experienced in normal Depot operations and do not result in appreciable differences in simulation results.

C. VALIDATION

Service time observation data necessary to validate this model is not available to the author. Before validation of the model can begin, frequency distributions of observed service times in F-157, all provisions storage locations and the packing section must be completed and entered as functions in the model. After all of the data distributions are established and verified in the models, the following validation procedure should be used.

In the validation phase, the credibility of the model is established by developing a set of actual performance statistics to compare to queue storage and table statistics produced by the program. Depot performance statistics from a period of at least one month of normal operating tempo should be collected to provide both the demand level to be simulated and the real system performance data used to judge model performance.

The first step in validation should be to review overall system performance. Problems observed in this step will serve as starting points in the identification of module-level problems. Statistics reported by NSD in the Issue Processing Analysis Section of the Supply Distribution and Inventory Control Report (NAVSUP 1144) should be compared to the IPGON, IPGTW and IPGTH tables in the output section of the program. More specifically, for each issue priority group, the cumulative percentage figure for the interval with the upper limit matching the corresponding UMMIPS processing time standard (one, two and eight days respectively) should be compared to the percent shipped on time figure reported on the NAVSUP 1144. Three different basic observations may be made at this point.

1. Simulation throughput time statistics closely approximates real system performance
2. Simulation throughput time statistics differ from real system performance uniformly across issue priority groups.
3. Simulation throughput time statistics differ from real system performance inconsistently across issue priority groups.

In the case of the first observation, remaining validation steps can be limited to a review of queue and storage program output sections. Observation of either of the other two results may require a detailed analysis of the input data used by the model (i.e., service times, storage capacities) and the program logic representing decision rules employed by NSD personnel.

If transaction throughput times by issue priority groups differ uniformly from real system performance, queue and storage data should be compared to corresponding workcenter workloads. For example, if simulated throughput times were uniformly slower than real system operation, queue "AVERAGE CONTENTS" and "AVERAGE TIME/TRANS" data should be examined. Queues reflecting high average contents and reporting long average time per transaction values relative to other queues should be reviewed first. Conversely, storages reporting high "UTILIZATION DURING AVAIL. TIME" should be examined before storages reporting low utilization. Real system workcenter backlogs, utilization rates and throughput should be compared to data from the suspect queues and storages. Discrepancies identified between actual workcenter performance and corresponding queue and storage statistics will most likely result from understated capacities, overstated or poorly defined service times, or both.

When deviation from real system performance does not occur uniformly across issue priority groups, program logic based on decision rules provided by NSD Yokosuka may not accurately reflect actual operations. For example, if simulated throughput times for IPG1 transactions were significantly faster than real system performance, while IPG2 and IPG3 performance was substantially as expected, handling of IPG1 requisitions in the program should be reviewed. Code segments modeling UC02/UC96 queue files and special delivery of IPG1 issue documents missing normal delivery runs should be compared to real system decision rules. If this review fails to produce an explanation for the discrepancy, intermediate MARK and TABULATE blocks should be inserted to measure throughput time in smaller segments of the program by issue priority groups in an effort to localize the problem.

The validation procedures discussed above are by no means all inclusive, however, they should serve as a guide to the validation process. Simulation model validation is an iterative process. After identified problems have been corrected, the program should be run and the results compared again against real system performance data. When validation is completed, input parameters and output statistics should be retained as a baseline for model experimentation.

VI. EXPERIMENTATION

One major purpose of simulation is to perform experimentation that will provide predictive information regarding real system performance under controlled changes to the system and its conditions. Simulation experiments reviewed in this chapter were conducted for the purpose of demonstrating experimentation techniques. The baseline program used during experimentation models NSD issue processing operations under a normal load of 43,000 requisitions a month and is identical to the program listing provided as Appendix A. The baseline program output referenced is the program output included as Appendix C. As the baseline program has not been validated, it should be emphasized that the results of this series of simulation experiments are useful for illustrative purposes only.

Consider the following demonstration of experimentation procedures. NSD Yokosuka Planning Division analysts have estimated that the support of an additional Carrier Battle Group (CBG) under peacetime conditions would result in a 70% increase in requisitions received. The objective of this series of experiments was to observe simulated issue processing operations of NSD Yokosuka for a period of four weeks under those conditions. The information obtained from the experimental models could be used to estimate the additional resources the Depot might require to continue providing approximately the same level of support.

The experimentation plan calls for an initial run to simulate NSD operations at a monthly demand level of 73,100 requisitions to identify processing bottlenecks in the system. After evaluation of the initial run is completed, adjustments to the model will be made reflecting options that would be available to the Depot during actual operation (i.e., additional personnel, shift changes, scheduling of additional tractor train runs.) After modifications to the model are completed, the simulation run will be repeated. The results of the second simulation will then be evaluated and the process will continue in an iterative manner until a satisfactory solution is obtained. This plan was executed and the results are explained below.

The throughput time tables, storage and queue statistics produced by the first experiment were compared to Appendix C. The percentage of issues, by issue priority group, made within UMMIPS time standards with UMMIPS performance statistics recorded during normal operating levels did not indicate a serious problem at first glance. IPG1 and IPG2 UMMIPS performance remained essential unchanged. The percentage of IPG3 issues made within the UMMIPS time standard of seven days (16,800 simulation time units) fell from 99.1% under normal conditions to 95.3%. The first indication of a problem was in the actual number of IPG3 issues. The 18,693 IPG3 issues recorded reflected an increase of only 9% over the 17,157 IPG3 issues made during the baseline experiment, though the number of requisitions received increased by 70%. A review of queue statistics explained the modest increase in IPG3 issues. Snapshot queue statistics confirmed that warehouse area A, the main warehouse, the B route tractor train and packing queues steadily increased in length indicating that arrival rates in those areas exceeded the service rates. This was confirmed by utilization rates in the corresponding storages approaching or equaling 100%. The Savevalue count BNUM (the B route tractor train count) underscored the issue transportation problem. The B route required 97 runs to transport issues from warehouse areas A, B, and J, exceeding the scheduled 80 runs by 21%.

Based on these changes in system performance due to the increase in load conditions, the "system" was modified in the following manner. Since processing bottlenecks were localized in relatively few workcenters, spot adjustments, as opposed to blanket shift changes, were made to compensate for the additional workload. The warehouse area A and main warehouse storage capacities were increased from 2 to 3 and from 8 to 11, respectively. Each modification required a change to the capacity listed in the storage definition block and to the number of transactions unlinked in the user chain control module. The number of heavy pack crews was increased from 3 to 4 and the number of personnel in the light pack line was increased from 5 to 7 by changes to the program code similar to those made to the warehouse storages. Additional tractor train runs on the B route were scheduled at 1500 and 1700 each workday. A single additional run was scheduled on the A route to handle the anticipated increase in issues from the main warehouse. The changes were implemented by duplicating code from an earlier train run, changing only the control transaction generation time. The management discretion train routes previously scheduled for 1500 were rescheduled to 1800 by changing the control transaction generation times.

After the changes were completed, the second simulation experiment was run. The number of IPG1 and IPG2 issues and their UMMIPS performance statistics remained stable in the second run. IPG3 issues increased from 18,693 to 26,403, an increase of 41% over the previous experiment and 54% over the baseline issues. The percentage of IPG3 issues made within UMMIPS time standards increased to 97.1%. The storage and queue statistics of warehouse area A and the main warehouse were returned to acceptable levels by the capacity increases. The A route tractor train queue lengths recorded in the snapshot statistics produced during the second experiment increased only slightly, indicating that the single additional run scheduled was sufficient to handle the increase in main warehouse issues that had been anticipated. The B route tractor train queue lengths showed significant improvement, however, the average transaction queue waiting time was an unacceptable 117 hours. Packing Section utilization remained at 100% with the increase in storage capacity partially offset by the increase in issues transported by the additional tractor train runs.

The results of the second run indicated that changes to the system were still required in the issue transportation and packing sections. In the third experiment, additional tractor train runs on the B route were scheduled at 0925 and 1125 on workdays to reduce the delay experienced by transactions waiting for transportation on the B route tractor train. The capacity of the heavy pack storage was increased from 4 to 5 and the light pack storage from 7 to 9. The simulation was repeated and results of third simulation experiment were examined. IPG1 and IPG2 statistics remained stable. The number of IPG3 issues rose to 28,683 with 97.8% of all issues made within UMMIPS time standards. All storage utilization rates had fallen sufficiently below 100% to eliminate the exploding queue characteristics observed in the previous experiments.

Experimentation could be continued to restore IPG3 UMMIPS performance standards observed in the baseline simulation by following the same procedures employed in the first three experiments. As observed during this series of experiments, obtaining the desired results is an iterative process. Modifications made to the model depend on the observed conditions unique to each experiment and are easily made by personnel with only a limited background in simulation techniques and GPSS.

VII. SUMMARY

A. CONCLUSIONS

1. Discrete Event Simulation Using GPSS V

Simulation using GPSS V can be an effective predictive tool for NSD Yokosuka planning personnel. The NSD is composed of interrelated queueing systems that may be accurately modeled by discrete event simulation techniques. The system throughput, resource utilization and queue statistics produced by GPSS V during simulation experimentation are well suited to the information requirements of logistics planners. Making program changes during system experimentation is a relatively simple process, well within the capability of personnel with only an introduction to GPSS.

2. Discrete Event Simulation Using GPSS/PC

NSD Yokosuka issue processing operations could not be modeled with Minuteman Software's GPSS/PC because of the substantial memory requirements of the model. Manufacturer suggestions that GPSS/PC will handle 2000 concurrently active transactions indicates that input stream compression on the order of 20 requisitions to each transaction will be necessary to keep memory requirements within the 640 kilobytes permitted by DOS.

B. RECOMMENDATIONS

1. Data Collection

The data collection efforts of NSD Yokosuka should be completed to permit model validation and experimentation using the present GPSS V program. The use of existing mean times to model requisition and issue document handling processes (i.e., remote terminal entry, document sorting) should not have an adverse impact on model performance due to the brief and uniform nature of the tasks. However, the greater length and variability of service times in warehouse locations and the Packing Section do not permit accurate modeling with estimated mean times. The construction of frequency distributions from random samples of actual service times in the provisions storage locations, F-157 and the Packing Section will be necessary to complete model validation.

2. Model Experimentation

If data collection and model validation efforts can be completed under the coordination of NSD Yokosuka, the cooperation of an activity equipped with an IBM mainframe computer operating under the VM/CMS operating system will be necessary to permit experimentation with the model. Other activities in Japan, the Naval Postgraduate School and the Navy Fleet Material Support Office all offer support possibilities.

3. Microcomputer Implementation of the Model

Eventual implementation of a microcomputer version of the model would permit NSD Yokosuka Planning Division analysts to experiment with the model interactively. If validation of the present model is completed, it should be converted to GPSS/PC and the modifications necessary to compress the input stream should be made. Validation of the GPSS/PC version should then be completed in the same manner as the original model.

APPENDIX A

PROGRAM LISTING

TABLE OF CONTENTS

Program Execution Control Module 54
Input Parameters Module. 55
Variable Computation Module. 57
Boolean Variable Computation Module. 59
Transaction Parameter Module 60
Storage Definition Module. 61
Functions Module 63
Master Schedule Control Module 66
Storage Control Module 67
User Chain Control Module. 68
Requisition Generation Module. 69
Requisition Receipt Module 71
NSD Remote Terminal Entry Module 72
CPU Tests Module 73
Printer Queue Handling Module. 74
Demand Exception Handling Module 75
Warehouse Assignment Module. 76
Storage Control/Storage Office Module. 77
Yokohama Issue Document Delivery Module. 78
Bicycle Messenger Delivery Module. 79
Warehouses Module. 80
Provisions Tractor Train Delivery Module 88
Tractor Train Delivery Module. 89
Freight Terminal Module. 92
Duty Section Module. 94
Termination Module 97
Simulation Run Control Module. 98

```
//YOKO JOB (4939,9999),'MIKE CLIFT',CLASS=G
//*MAIN LINES=(40)
// EXEC GPSSV,REGION.GO=2048K
//SYSIN DD *
       REALLOCATE XAC,20000
       REALLOCATE FAC,0
       REALLOCATE LOG,0
       REALLOCATE TAB,10
       REALLOCATE FSV,15
       REALLOCATE HSV,0
       REALLOCATE BSV,0
       REALLOCATE LSV,0
       REALLOCATE GRP,0
       REALLOCATE FMS,0
       REALLOCATE HMS,0
       REALLOCATE BMS,0
       REALLOCATE LMS,0
       REALLOCATE STO,100
       REALLOCATE QUE,100
       REALLOCATE COM,500000
**********************************************************************
**                   PROGRAM EXECUTION CONTROL                       **
** THE SIMULATE STATEMENT MUST FOLLOW ALL JCL STATEMENTS AND GPSS   **
** REALLOCATE STATEMENTS. IT MARKS THE BEGINNING OF THE EXECUTABLE  **
** PROGRAM. THE PRECEDING REALLOCATE STATEMENTS ARE USED TO ALLOCATE**
** ADDRESSABLE MEMORY AMONG VARIOUS ENTITIES DEFINED IN THE PROGRAM.**
**********************************************************************
*
       SIMULATE                        BEGIN SIMULATION
*
```

```
**********************************************************************
**                  INPUT PARAMETERS                                **
** INPUT PARAMETER VARIABLES ARE ASSIGNED VALUES FROM DATA PROVIDED **
** BY NSD. INPUT PARAMETER VARIABLES ARE USED TO CONTROL THE NUMBER **
** AND TYPE OF TRANSACTIONS GENERATED IN THE SIMULATION. THEY MAY   **
** BE CHANGED FOR THE PURPOSE OF EXPERIMENTATION.                   **
**********************************************************************
*
**DEMAND LEVEL INPUT PARAMETER****************************************
*
**TOTAL DEMANDS PER MONTH**
 DMAND VARIABLE   43000
*
**INPUT PARAMETERS EXPRESSED IN NUMBER PER 1000 REQS REC'D************
*
**GROSS AVAILABILITY**
 GROSS VARIABLE   651
*
**REQUISITIONS RECEIVED VIA AUTODIN, DOSS OR LOCAL CUSTOMER RTE**
 ONLIN VARIABLE   447
*
**NO OF WEEKDAY DEMANDS REC'D DURING WORKDAY**
 DAYDD VARIABLE   891
*
**DEMAND EXCEPTIONS**
 DMDEX VARIABLE   63
*
**PERISHABLE PROVISIONS REQS - 9MP/9MB**
 PERPV VARIABLE   177
*
**DRY PROVISIONS REQS - 9MF**
 DRYPV VARIABLE   67
*
**SHIPS STORE STOCK REQS - 1Q**
 SSS   VARIABLE   13
*
****INPUT PARAMETERS EXPRESSED IN NUMBER PER 1000 ISSUES***************
*
**WAREHOUSE REFUSALS**
 WHREF VARIABLE   3
*
**INPUT PARAMETERS EXPRESSED IN AVERAGE WEIGHT IN LBS OF THREE ISSUES **
**FOR EACH WAREHOUSE AREA (TWO THOUSAND LBS PER MEASUREMENT TON)      **
*
**YOKOHAMA COLD STORAGE**
 YMCSW VARIABLE   1245
*
**YOKOSUKA COLD STORAGE (BLDG 1390)**
 YKCSW VARIABLE   1647
*
**DRY (B-47) WAREHOUSE**
 DRYWW VARIABLE   999
*
**A WAREHOUSE**
 AWHEW VARIABLE   1881
*
**B WAREHOUSE**
 BWHEW VARIABLE   2124
*
**MAIN (F-157) WAREHOUSE**
 MAINW VARIABLE   381
*
**F WAREHOUSE**
 FWHEW VARIABLE   2283
*
**J WAREHOUSE**
 JWHEW VARIABLE   3096
```

```
**INPUT PARAMETER - ENTER ISSUE BACKLOG THRESHOLD (LBS) *****************
**REQUIRED TO SCHEDULE AN ADDITIONAL TRACTOR TRAIN RUNS *****************
*
**ATRN ROUTE**
 AXTRA VARIABLE   64000
*
**BTRN ROUTE**
 BXTRA VARIABLE   64000
*
**PROVISIONS WAREHOUSE ROUTE**
 PXTRA VARIABLE   32000
*
**INPUT PARAMETER EXPRESSED IN NO. PER 1000 ISSUES RECEIVED IN PACKING***
*
**NO. ISSUES FOR LIGHT OR PARCEL POST PACK**
 LITEP VARIABLE   911
```

```
**********************************************************************
**                    VARIABLE COMPUTATION                          **
** SYMBOLIC NAME, COMPUTATION AND DEFINITION OF VARIABLES REFERENCED**
** DURING THE SIMULATION. VARIABLE VALUES ARE COMPUTED FROM INPUT   **
** PARAMETER VARIABLES, OTHER DEFINED VARIABLES OR FUNCTIONS.       **
**********************************************************************
*
**********COMPUTE DAY OF WEEK INDICATOR************
**MON=1  TUES=2  WED=3  THU=4 FRI=5  SAT=6  SUN=0**
 DAY   VARIABLE   N$DAYC@7
*
**COMPUTE TIME OF DAY**
 TIME  VARIABLE   C1@2400
*
**NO OF WEEKDAY DEMANDS NOT REC'D  DURING WORKDAY PER 1000 REQS REC'D**
 NITDD VARIABLE   1000-V$DAYDD
*
**WEEKLY DEMANDS GIVEN MONTHLY DEMAND LEVEL**
 WDMND VARIABLE   (V$DMAND*231)/1000
*
**DAILY DEMANDS GIVEN MONTHLY DEMAND**
 DDMND VARIABLE   ((V$WDMND*FN$FTHNN)/1000)/3
*
**DEMANDS RECEIVED DURING THE WORKDAY**
 WRKDD VARIABLE   (V$DDMND*V$DAYDD)/1000
*
**DEMANDS RECEIVED DURING THE WORKDAY AM**
 AMDD  VARIABLE   (((V$DDMND*V$NITDD)/1000)*800)/1525
*
**DEMANDS RECEIVED DURING THE WORKDAY PM**
 PMDD  VARIABLE   (((V$DDMND*V$NITDD)/1000)*725)/1525
*
**NO REQS SENT TO REQUIREMENTS DIV. FOR STOCK CHECK PER 1000 REQS REC'D**
 RQCHK VARIABLE   V$PERPV+V$SSS
*
**NO REQS SENT TO REQUIREMENTS DIV. FOR STOCK**
**CHECK PER 1000 HARD COPY REQS REC'D        **
 RQDIV VARIABLE   1000*V$RQCHK/(1000-V$ONLIN)
*
**PROVISIONS REQS PER 1000 REQS REC'D**
 PROV  VARIABLE   V$PERPV+V$SSS+V$DRYPV
*
**NO OF DEMAND EXCEPTIONS PER MONTH**
 NUMEX VARIABLE   V$DMAND*V$DMDEX/1000
*
**NET DEMAND EXCEPTIONS PER 1000 ISSUES**
 NETEX VARIABLE   V$NUMEX*1000/((V$GROSS*V$DMAND)/1000)
*
**TRANSACTIONS NOT DEMAND EXCEPTION PER 1000 ISSUES**
 NOTEX VARIABLE   1000-V$NETEX
*
**ISSUES NOT WAREHOUSE REFUSALS PER 1000 ISSUE DOCS SENT TO WAREHOUSE**
 NOTWR VARIABLE   1000-V$WHREF
*
**SERVICE TIME VARIABLES (SUM OF 3 FUNCTION CALLS)********************
*
 INEXP FVARIABLE  FN$FFORT+FN$FFORT+FN$FFORT+.5
```

```
**SERVICE TIME VARIABLES FOR GROUPS OF THREE - SERVICE TIME MEAN  ****
**MULTIPLIED BY V$INEXP FOR SERVICE TIME CONSTRUCTED FROM MEANS - ****
**SUM OF THREE SERVICE TIME FUNCTION CALLS FOR SERVICE TIMES      ****
**CONSTRUCTED FROM CONTINUOUS DISTRIBUTIONS                       ****

 SKCKS VARIABLE   FN$FELEV*V$INEXP
*
 RTES  VARIABLE   FN$FTWEL*V$INEXP
*
 DEEXS VARIABLE   FN$FTHTN*V$INEXP
*
 SCSOS VARIABLE   FN$FSXTN*V$INEXP
*
 YMCSS VARIABLE   FN$FEITN*V$INEXP
*
 YKCSS VARIABLE   FN$FNNTN*V$INEXP
*
 DRYWS VARIABLE   FN$FTWEN*V$INEXP
*
 AWHES VARIABLE   FN$FTWON+FN$FTWON+FN$FTWON
*
 BWHES VARIABLE   FN$FTWTW+FN$FTWTW+FN$FTWTW
*
 MAINS VARIABLE   FN$FTWTH*V$INEXP
*
 FWHES VARIABLE   FN$FTWFR+FN$FTWFR+FN$FTWFR
*
 JWHES VARIABLE   FN$FTWFV+FN$FTWFV+FN$FTWFV
*
 HVYPS VARIABLE   FN$FTWSX*V$INEXP
*
 LITPS VARIABLE   FN$FTWSV*V$INEXP
*
**ESTIMATED WEIGHT OF TRANSACTIONS AWAITING THE TRACTOR TRAINS********
*
**ATRN ROUTE**
 AWGHT VARIABLE   (CH$MAINC*V$MAINW)+(CH$FCH*V$FWHEW)
*
**BTRN ROUTE**
 BWGHT VARIABLE   (CH$ACH*V$AWHEW)+(CH$BCH*V$BWHEW)+(CH$JCH*V$JWHEW)
*
**PROVISIONS WAREHOUSE ROUTE**
 PWGHT VARIABLE   CH$PTRNC*((V$YKCSW+V$DRYWW)/2)
*
**VARIABLE COUNTS GROUPS OF 3 LEAVING DUTY SECTION MODULE*************
 COUNT VARIABLE   N$DUTTR@3
```

```
**********************************************************************
**             BOOLEAN VARIABLE COMPUTATION                         **
** SYMBOLIC NAME, COMPUTATION AND DEFINITION OF BOOLEAN VARIABLES   **
** REFERENCED IN THE SIMULATION. BOOLEAN VARIABLES ARE USED IN THE  **
** SIMULATION TO CONTROL OPERATIONS SCHEDULING.                     **
**********************************************************************
*
**WORKDAY INDICATOR, TRUE (1) IF MONDAY THROUGH FRIDAY**
 WKDAY BVARIABLE  V$DAY'GE'K1*V$DAY'LE'K5
*
**LUNCHTIME INDICATOR, TRUE IF 1201 - 1245 ON WORKDAY
 LUNCH BVARIABLE  V$TIME'GE'K1201*V$TIME'LE'K1275*BV$WKDAY'E'K1
*
**NIGHTTIME INDICATOR, TRUE IF BEFORE 0801 OR AFTER 1645 ON WORKDAY
 NIGHT BVARIABLE  (V$TIME'GE'K1676+V$TIME'LE'K800)*BV$WKDAY'E'K1
*
**WORKING HOURS INDICATOR, TRUE IF 0801 - 1200 OR 1246 - 1645 ON WORKDAY
 WORKH BVARIABLE  BV$LUNCH'E'K0*BV$NIGHT'E'K0*BV$WKDAY'E'K1
*
**DEPOT OPEN INDICATOR, TRUE IF 0801 - 1645 ON WORKDAY .
 OPEN  BVARIABLE  BV$LUNCH'E'K1+BV$WORKH'E'K1
*
 PTIME BVARIABLE  V$TIME'E'800+V$TIME'E'1000+V$TIME'E'1275+V$TIME'E'1475
*                                      SET TO TRUE AT IPG2 PRINT TIMES
*
 PRTWO BVARIABLE  BV$WKDAY'E'K1*BV$PTIME'E'K1
*                                      SET TO TRUE ON WORKDAYS TO PRINT
*                                      IPG2 BATCH
*
 PRTHR BVARIABLE  BV$WKDAY'E'1*V$TIME'E'800
*                                      SET TO TRUE ON WORKDAYS TO PRINT
*                                      IPG3 BATCH
*
 BTIME BVARIABLE  V$TIME'E'900+V$TIME'E'1100+V$TIME'E'1375+V$TIME'E'1525
*                                      SET TO TRUE AT ISSUE DOC DELIVERY
*                                      TIMES
*
 DTIME BVARIABLE  BV$WKDAY'E'K1*BV$BTIME'E'K1
*                                      SET TO TRUE AT DELIVERY TIME ON
*                                      WORKDAYS
*
**BOOLEAN VARIABLE SET TO TRUE IF ISSUE FOR BEARER PICK-UP**
 BEAR  BVARIABLE  P1'E'K7+P1'E'K5+P1'E'K3
*
**BOOLEAN VARIABLE SET TO TRUE ON EVERY THIRD TRANSACTION LEAVING DUTY**
 THREE BVARIABLE  V$COUNT'E'0
```

```
**********************************************************************
**            TRANSACTION PRIORITIES AND PARAMETERS                 **
** KEY TO PRIORITIES AND PARAMETERS ASSIGNED AND REFERENCED DURING  **
** THE SIMULATION.                                                  **
**********************************************************************
*
*PRIORITY    REQ PRIORITY              MATCHES P1
*
*P1          REQ PRIORITY              IPG1 BWT            = 7
*                                      IPG1 (ALL OTHER)    = 6
*                                      IPG2 BWT            = 5
*                                      IPG2 CASREPT
*                                      (NOT BWT)           = 4
*                                      IPG2 QUICK PICK     = 3
*                                      IPG2 (ALL OTHER)    = 2
*                                      IPG3                = 1
*
*P2          STORAGE AREAS             YOKOHAMA COLD STORAGE  = 1
*                                      YOKOSUKA COLD STORAGE  = 2
*                                      (BUILDING 1390)
*                                      DRY PROVISIONS         = 3
*                                      (B-47)
*                                      A AREA WAREHOUSES      = 4
*                                      (A-19)
*                                      B AREA WAREHOUSES      = 5
*                                      (B-33,B-45,B-46)
*                                      MAIN WAREHOUSE         = 6
*                                      (F-157)
*                                      F AREA WAREHOUSES      = 7
*                                      (F-8,F-9,F-10,F-11,
*                                      F-12,F-13,F-14)
*                                      J AREA WAREHOUSES     = 8
*                                      (J-11,J-12 AND GAS,
*                                      LUMBER AND DRUM YARDS)
*
*
*P3          TRANSACTION POINT OF      PARAMETER VALUES EVALUATED
*            PROGRESS PARAMETER        BY FUNCTIONS FTHIR AND FTHON
*            (SPECIFIES DUTY SECTION
*            PROCESSING REQUIRED AND/
*            OR POINT OF RETURN FOR
*            TRANSACTIONS NOT
*            PROCESSED BY THE DUTY
*            SECTION)
*
*P4          NSD TRANSPORTATION        MAJOR CUSTOMER (PWC,SRF)  = 1
*            DESTINATIONS              NOTE: NOT ASSIGNED IN
*                                      PROVISIONS STORAGE LOCATIONS
*                                      PACKING DIVISION          = 2
*                                      FREIGHT TERMINAL DIVISION = 3
*
*P5          ISSUE WEIGHT              WEIGHT ASSIGNED TO TRANSACTIONS
*                                      EXPRESSED IN LBS
*
*P6          STOCK STATUS              NIS/NC   = 1
*                                      IN STOCK = 2
*
*P7          DEMAND EXCEPTION STATUS   PROCESSED DEMAND EXCEPTION = 1
*
*P8          WAREHOUSE REFUSAL STATUS  WAREHOUSE REFUSAL = 1
```

```
**********************************************************************
**                     STORAGE DEFINITIONS                          **
** SYMBOLIC ADDRESS, CAPACITY AND BRIEF EXPLANATION OF NSD          **
** FUNCTIONAL AREAS MODELED AS STORAGES WITHIN THE SIMULATION.      **
** CAPACITIES REFLECT NUMBER OF PERSONNEL WORKING IN THE MODELED    **
** WORKCENTER EXCEPT FOR THE ATRN AND BTRN STORAGES WHICH REFLECT   **
** TRACTOR TRAIN CAPACITY IN POUNDS.                                **
**********************************************************************
*
       STORAGE    S$SKCK,6             NO OF CLERKS IN REQUIREMENTS
*                                      PERFORMING STOCK CHECKS
*
       STORAGE    S$CRTE,5             NO OF RTE OPERATORS IN CUST SERV
*                                      ENTERING REQS
*
       STORAGE    S$DRTE,2             NO OF RTE OPERATORS IN DPSC
*                                      ENTERING REQS
*
       STORAGE    S$DEEX,2             NO OF CLERKS IN CUST SERV
*                                      PROCESSING DEMAND EXCEPTIONS
*
       STORAGE    S$SCPR,100000        STORAGE CONTROL PRINTER, UNLIMITED
*                                      CAPACITY
*
       STORAGE    S$CSPR,100000        CUST SERV PRINTER, UNLIMITED
*                                      CAPACITY
*
       STORAGE    S$SCNT,4             NO OF STORAGE CONTROL PERSONNEL
*                                      MARKING,BURSTING AND SORTING
*                                      ISSUE DOCUMENTS
*
       STORAGE    S$STOF,1             NO OF STORAGE OFFICE PERSONNEL
*                                      MARKING,BURSTING AND SEGREGATING
*                                      ISSUE DOCUMENTS
*
       STORAGE    S$DLVR,100000        ISSUE DOC DELIVERY TO YOKOHAMA
*                                      COLD STORAGE, UNLIMITED CAPACITY
*
       STORAGE    S$YMCS,11            NO. OF WAREHOUSE PERSONNEL AT
*                                      YOKOHAMA COLD STORAGE IN ISSUE AND
*                                      SHIPMENT PREP OPERATIONS
*
       STORAGE    S$YKCS,4             NO. OF WAREHOUSE PERSONNEL AT
*                                      BUILDING 1390 (YOKSUKA COLD STOR.)
*                                      IN ISSUE AND SHIPMENT PREP
*                                      OPERATIONS
*
       STORAGE    S$DRYW,2             NO. OF WAREHOUSE PERSONNEL AT
*                                      YOKOSUKA DRY STORAGE (B-47) IN
*                                      ISSUE AND SHIPMENT PREP OPERATIONS
*
       STORAGE    S$AWHE,2             NO. OF WAREHOUSE PERSONNEL AT
*                                      A AREA WAREHOUSES IN ISSUE OPS
*
       STORAGE    S$BWHE,2             NO. OF WAREHOUSE PERSONNEL AT
*                                      B AREA WAREHOUSES IN ISSUE OPS
*
       STORAGE    S$MAIN,8             NO. OF WAREHOUSE PERSONNEL AT
*                                      F-157 IN ISSUE OPS
*
       STORAGE    S$FWHE,1             NO. OF WAREHOUSE PERSONNEL AT
*                                      F AREA WAREHOUSES IN ISSUE OPS
*
       STORAGE    S$JWHE,4             NO. OF WAREHOUSE PERSONNEL AT
*                                      J AREA WAREHOUSES IN ISSUE OPS
```

```
       STORAGE    S$ATRN,32000          CAPACITY, EXPRESSED IN POUNDS, OF
*                                       THE ON-BASE TRACTOR
*                                       TRAIN (A-ROUTE)
*
       STORAGE    S$BTRN,32000          CAPACITY, EXPRESSED IN POUNDS OF
*                                       THE ON-BASE TRACTOR
*                                       TRAIN (B-ROUTE)
*
       STORAGE    S$PTRN,32000          PROVISIONS TRACTOR TRAIN,
*                                       CAPACITY NOT REFERENCED DURING
*                                       SIMULATION
*
       STORAGE    S$LITP,5              NO OF PACKERS IN LIGHT PACK LINE
*
       STORAGE    S$HVYP,3              NO OF HEAVY PACK CREWS
*
       STORAGE    S$DUTY,2              TWO MAN DUTY SECTION
*
       STORAGE    S$BIKE,100000         BICYCLE MESSENGER DELIVERING ISSUE
*                                       DOCUMENTS TO YOKOSUKA STORAGE
*                                       LOCATIONS
```

```
************************************************************************
**                        FUNCTIONS                                   **
** DEFINITION OF FUNCTIONS USED IN THE SIMULATION PROGRAM. FUNCTIONS**
** ARE PARTIONED BY TYPE.                                             **
************************************************************************
*
**PARAMETER ASSIGNMENT FUNCTIONS***************************************
*
 FONE  FUNCTION   RN1,D7                REQ PRIORITY
0.66696,1/.96695,2/.96978,3/.96995,4/.98713,5/.99983,6/1.0,7
*
 FTWO  FUNCTION   RN1,D8                WAREHOUSE LOCATION ASSIGNMENT
0.17127,1/.22920,2/.30846,3/.35334,4
0.40118,5/.90023,6/.94454,7/1.0,8
*
*                                       ASSIGNS FUNCTION TO PROVIDE ISSUE
 FTHRE FUNCTION   P2,E8                 DESTINATION IN DUTY SECTION MODULE
1,FN$FFOUR/2,FN$FFOUR/3,FN$FFIVE/4,FN$FSIX/5,FN$FSEVE
6,FN$FEIGH/7,FN$FNINE/8,FN$FTEN
*
 FFOUR FUNCTION   RN1,D2                BLDG 1390 ISSUE DEST. ASSIGN.
0.9326,1/1.0,2
*
 FFIVE FUNCTION   RN1,D2                B-47 ISSUE DESTINATION ASSIGNMENT
0.6264,1/1.0,2
*
 FSIX  FUNCTION   RN1,D3                A AREA ISSUE DESTINATION ASSIGN.
0.0389,1/.6897,2/1.0,3
*
 FSEVE FUNCTION   RN1,D3                B AREA ISSUE DESTINATION ASSIGN.
0.2888,1/.7744,2/1.0,3
*
 FEIGH FUNCTION   RN1,D3                F-157 ISSUE DESTINATION ASSIGN.
0.0167,1/.6772,2/1.0,3
*
 FNINE FUNCTION   RN1,D3                F AREA ISSUE DESTINATION ASSIGN.
0.3662,1/.8054,2/1.0,3
*
 FTEN  FUNCTION   RN1,D3                J AREA ISSUE DESTINATION ASSIGN.
0.1357,2/.7312,2/1.0,3
*
**SERVICE TIME ASSIGNMENT FUNCTIONS***********************************
*
 FELEV FUNCTION   RN1,D2                STOCK CHECK SERVICE TIME
0.0,0/1.0,1
*
 FTWEL FUNCTION   RN1,D2                REMOTE TERMINAL ENTRY SERVICE TIME
0.0,0/1.0,1
*
*                                       FUNCTION ASSIGNMENT FOR DEMAND
 FTHTN FUNCTION   P8,E2                 EXCEPTION PROCESSING
0,FN$FFRTN/1,FN$FFFTN
*
 FFRTN FUNCTION   RN1,D2                DEMAND EXCEP. PROCESSING TIME
0.0,0/1.0,1
*
 FFFTN FUNCTION   RN1,D2                WAREHOUSE REF. PROCESSING TIME
0.0,0/1.0,5
*
*                                       STORAGE CONTROL/STORAGE OFFICE
 FSXTN FUNCTION   RN1,D2                ISSUE DOC HANDLING TIME
0.0,0/1.0,1
```

```
*                                      ASSIGNS FUNCTION TO PROVIDE
 FSVTN FUNCTION   P2,E8                WAREHOUSE SERVICE TIME
1,FN$FEITN/2,FN$FNNTN/3,FN$FTWEN/4,FN$FTWON
5,FN$FTWTW/6,FN$FTWTH/7,FN$FTWFR/8,FN$FTWFV
*
 FEITN FUNCTION   RN1,D2               YOKOHAMA C/S PICK TIME
0.0,0/1.0,17
*
 FNNTN FUNCTION   RN1,D2               YOKOSUKA C/S (BLDG 1390) PICK TIME
0.0,0/1.0,17
*
 FTWEN FUNCTION   RN1,D2               B-47 PICK TIME
0.0,0/1.0,7
*
 FTWON FUNCTION   RN1,C24              A-19 PICK TIME
0.038,3/.115,5/.192,7/.269,8/.308,10/.333,12
0.359,13/.423,15/.474,17/.551,18/.628,20
0.654,22/.692,23/.744,25/.756,27/.769,28/.859,30
0.872,32/.936,33/.949,40/.962,43/.974,47/.987,50/1.0,57
*
 FTWTW FUNCTION   RN1,C6               B WAREHOUSE PICK TIME
0.045,7/.545,8/.682,10/.818,13/.955,17/1.0,25
*
 FTWTH FUNCTION   RN1,D2               F-157 PICK TIME
0.0,0/1.0,8
*
 FTWFR FUNCTION   RN1,C9               F WAREHOUSE PICK TIME
0.153,1/.292,2/.319,3/.472,5
0.514,7/.681,8/.917,10/.958,12/1.0,17
*
 FTWFV FUNCTION   RN1,C23              J WAREHOUSE PICK TIME
0.008,3/.085,5/.185,7/.385,8/.462,10/.547,12
0.585,13/.600,15/.677,17/.692,18/.708,20/.754,25
0.770,27/.854,33/.885,37/.892,40/.915,42/.931,45
0.946,47/.969,50/.985,53/.992,200/1.0,267
*
 FTWSX FUNCTION   RN1,D2               HEAVY PACK SERVICE TIME
0.0,0/1.0,42
*
*                                      FUNCTION ASSIGNMENT FOR LIGHT/
 FTWSV FUNCTION   RN1,E2               PARCEL POST PROCESSING TIME
0.939,FN$FTWEI/1.0,FN$FTWNN
*
 FTWEI FUNCTION   RN1,D2               LIGHT PACK SERVICE TIME
0.0,0/1.0,7
*
 FTWNN FUNCTION   RN1,D2               PARCEL POST PACK SERVICE TIME
0.0,0/1.0,8
*
**TRANSACTION TRANSFER LOCATION ASSIGNMENT****************************
*
*                                      TRANSFER LOCATION FOR TRANSACTIONS
*                                      NOT HANDLED BY THE DUTY SECTION
 FTHIR FUNCTION   P3,D26               OR NOT RESULTING IN AN ISSUE
0,SKCKQ/1,CRTEQ/2,DTNIS/3,DEEXQ/4,SCNTQ/5,STOFQ/6,DLVRQ/7,BIKEQ
8,YMCSQ/9,YKCSQ/10,DRYWQ/11,AWHEQ/12,BWHEQ/13,MAINQ/14,FWHEQ/15,JWHEQ
16,PQUE/17,AQUE/18,BQUE/19,MQUE/20,FQUE/21,JQUE/22,HVYPQ/23,LITPQ
24,ALLCT/25,DTWR
```

```
*                                      TRANSFER LOCATION WITHIN DUTY
 FTHON FUNCTION   P3,D23               SECTION BASED ON P3
0,PZERO/1,PONE/3,PTHRE/4,PFOUR/5,PFOUR/6,PSIX/7,PSIX/8,PEIGH
9,PEIGH/10,PEIGH/11,PEIGH/12,PEIGH/13,PEIGH/14,PEIGH/15,PEIGH/16,PSXTN
17,PSXTN/18,PSXTN/19,PSXTN/20,PSXTN/21,PSXTN/22,PTWTW/23,PTWTH
*
 FTHTW FUNCTION   P2,D8                WAREHOUSE LOCATION TRANSFER
1,YMCSQ/2,YKCSQ/3,DRYWQ/4,AWHEQ/5,BWHEQ/6,MAINQ/7,FWHEQ/8,JWHEQ
*
*                                      CONTROL TRANSACTION DESTINATION
 FTHTH FUNCTION   P1,D8                IN SIMULATION TIME CONTROL MODULE
1,SONE/2,STWO/3,STHRE/4,SFOUR/5,SFIVE/6,SSIX
7,SSEVE/8,SEIGH
*
*                                      TRANSFER LOCATION FOR TRACTOR
 FTHFR FUNCTION   P2,D2                TRAIN OVERFLOW (A ROUTE)
6,MLINK/7,FLINK
*
*                                      TRANSFER LOCATION FOR TRACTOR
 FTHFV FUNCTION   P2,D3                TRAIN OVERFLOW (B ROUTE)
4,ALINK/5,BLINK/8,JLINK
*
**TRANSPORTATION TIME ASSIGNMENT FUNCTIONS****************************
*
*                                      BICYCLE MESSENGER ROUTE TIME
 FTHSX FUNCTION   P2,D7                ASSIGN. FOR ISSUE DOC DELIVERY
2,73/3,18/4,50/5,28/6,7/7,7/8,75
*
*                                      CUSTOMER SERVICE TO WAREHOUSE
 FTHSV FUNCTION   P2,D8                TRANSPORTATION TIMES
1,150/2,10/3,3/4,15/5,5/6,2/7,3/8,13
*                                      WAREHOUSE LOCATION TO BLDG J-39
 FTHEI FUNCTION   P2,D7                TRANSPORTATION TIMES
2,12/3,7/4,13/5,3/6,5/7,8/8,7
*
**DAILY DEMAND LEVEL ASSIGNMENT FUNCTIONS****************************
*
*                                      AVERAGE % OF WEEKLY DEMANDS
 FTHNN FUNCTION   V$DAY,D7             EXPERIENCED ON EACH DAY
0,21/1,168/2,150/3,200/4,201/5,205/6,55
*
**STANDARD DISTRIBUTION FUNCTIONS*************************************
*
 FFORT FUNCTION   RN1,C24              INVERSE EXPONENTIAL FUNCTION
0.0,0/.1,.104/.2,.222/.3,.355/.4,.509/.5,.69
0.6,.915/.7,1.2/.75,1.38/.8,1.6/.84,1.83/.88,2.12
0.9,2.3/.92,2.52/.94,2.81/.95,2.99/.96,3.2/.97,3.5
0.98,3.9/.99,4.6/.995,5.3/.998,6.2/.999,7/.9998,8
```

```
**********************************************************************
**                MASTER SCHEDULE CONTROL                           **
** SIMULATE ONE WEEK OF OPERATIONS IN INCREMENTS OF .01 HOURS. A    **
** CONTROL TRANSACTION IS GENERATED AT THE BEGINNING OF EACH DAY.   **
** ADVANCE BLOCKS ARE USED TO MOVE THE TRANSACTION THROUGH A        **
** WORKDAY SCHEDULE. AT APPROPRIATE TIMES, STORAGES REPRESENTING    **
** DEPOT WORKCENTERS ARE OPENED AND CLOSED AND TRANSACTIONS ARE     **
** LINKED TO AND UNLINKED FROM USER CHAINS BY SENDING THE CONTROL   **
** TRANSACTION TO THE STORAGE CONTROL AND USER CHAIN CONTROL        **
** MODULES.                                                         **
**********************************************************************
*
       GENERATE   16800                 GENERATE SIMULATION CONTROL
*                                       TRANSACTION
       TERMINATE  1                     TERMINATE SIMULATION
*
**GENERATE A CONTROL TRANSACTION AT THE BEGINNING OF EACH DAY*********
*
 DAYC  GENERATE   2400,0,1              GENERATE CONTROL TRANSACTION
*
       TEST E     BV$WKDAY,K1,SEIGH     SEND TO SEIGH IF SAT/SUN ELSE NEXT
*                                       BLOCK
       ASSIGN     1,K1                  TAG FOR RETURN
       TRANSFER   ,UNAVL                SEND TO UNAVL
*
 SONE  ADVANCE    800                   ADVANCE TO 0801
       ASSIGN     1,K2                  TAG FOR RETURN
       TRANSFER   ,AVAIL                SEND TO AVAIL
 STWO  ASSIGN     1,K3                  TAG FOR RETURN
       TRANSFER   ,START                SEND TO START
*
 STHRE ADVANCE    400                   ADVANCE TO 1201
       ASSIGN     1,K4                  TAG FOR RETURN
       TRANSFER   ,UNAVL                SEND TO UNAVL
*
 SFOUR ADVANCE    75                    ADVANCE TO 1246
       ASSIGN     1,K5                  TAG FOR RETURN
       TRANSFER   ,AVAIL                SEND TO AVAIL
 SFIVE ASSIGN     1,K6                  TAG FOR RETURN
       TRANSFER   ,START                SEND TO START
*
 SSIX  ADVANCE    400                   ADVANCE TO 1646
       ASSIGN     1,K7                  TAG FOR RETURN
       TRANSFER   ,UNAVL                SEND TO UNAVL
 SSEVE ASSIGN     1,K8                  TAG FOR RETURN
       TRANSFER   ,FNISH                SEND TO FNISH
 SEIGH TERMINATE                        TERMINATE CONTROL TRANSACTION
```

```
*********************************************************************
**                      STORAGE CONTROL                            **
** AVAILABILITY OF STORAGES IS CONTROLLED BY THE MASTER SCHEDULE   **
** CONTROL MODULE. SUNAVAIL CLOSES STORAGES, SAVAIL OPENS THEM     **
** TO COINCIDE WITH NSD NORMAL WORKDAY SCHEDULE. PROCESSING OF     **
** TRANSACTIONS IN STORAGES WHEN THEY ARE MADE UNAVAILABLE  IS     **
** COMPLETED.                                                      **
*********************************************************************
*
 UNAVL SUNAVAIL   SKCK
       SUNAVAIL   CRTE
       SUNAVAIL   DRTE
       SUNAVAIL   DEEX
       SUNAVAIL   SCNT
       SUNAVAIL   STOF
       SUNAVAIL   YMCS
       SUNAVAIL   YKCS
       SUNAVAIL   DRYW
       SUNAVAIL   AWHE
       SUNAVAIL   BWHE
       SUNAVAIL   MAIN
       SUNAVAIL   FWHE
       SUNAVAIL   JWHE
       SUNAVAIL   LITP
       SUNAVAIL   HVYP
       TRANSFER   FN,FTHTH            RETURN TO SIMULATION TIME CONTROL
*
 AVAIL SAVAIL     SKCK
       SAVAIL     CRTE
       SAVAIL     DRTE
       SAVAIL     DEEX
       SAVAIL     SCNT
       SAVAIL     STOF
       SAVAIL     YMCS
       SAVAIL     YKCS
       SAVAIL     DRYW
       SAVAIL     AWHE
       SAVAIL     BWHE
       SAVAIL     MAIN
       SAVAIL     FWHE
       SAVAIL     JWHE
       SAVAIL     LITP
       SAVAIL     HVYP
       TRANSFER   FN,FTHTH            RETURN TO SIMULATION TIME CONTROL
```

```
***********************************************************************
**                    USER CHAIN CONTROL                             **
** TRANSACTIONS ARE PLACED ON USER CHAINS TO SAVE EXECUTION TIME     **
** AND TO MAINTAIN CONTROL OF TRANSACTIONS THAT MUST BE WORKED BY    **
** THE DUTY SECTION. THE "FNISH" SEGMENT REMOVES ALL TRANSACTIONS    **
** FROM LISTED USER CHAINS AT THE END OF THE WORKDAY AND, WITHIN     **
** THEIR RESPECTIVE MODULES, HIGH PRIORITY REQUISITIONS ARE SENT TO  **
** THE DUTY SECTION MODULE FOR PROCESSING. THE "START" SEGMENT       **
** RELEASES ENOUGH TRANSACTIONS TO FILL THE RESPECTIVE STORAGES      **
** EACH WORKDAY MORNING AND IMMEDIATELY AFTER LUNCH.                 **
***********************************************************************
*
 FNISH UNLINK     SKCKC,SKCKT,ALL,BACK
       UNLINK     CRTEC,CRTET,ALL,BACK
       UNLINK     DEEXC,DEEXT,ALL,BACK
       UNLINK     SCNTC,SCNTT,ALL,BACK
       UNLINK     STOFC,STOFT,ALL,BACK
       UNLINK     YMCSC,YMCST,ALL,BACK
       UNLINK     YKCSC,YKCST,ALL,BACK
       UNLINK     DRYWC,DRYWT,ALL,BACK
       UNLINK     AWHEC,AWHET,ALL,BACK
       UNLINK     BWHEC,BWHET,ALL,BACK
       UNLINK     MAINC,MAINT,ALL,BACK
       UNLINK     FWHEC,FWHET,ALL,BACK
       UNLINK     JWHEC,JWHET,ALL,BACK
       UNLINK     HVYPC,HVYPT,ALL,BACK
       UNLINK     LITPC,LITPT,ALL,BACK
       TRANSFER   FN,FTHTH             RETURN TO SIMULATION TIME CONTROL
*
 START UNLINK     SKCKC,SKCKE,6,BACK
       UNLINK     CRTEC,CRTEE,5,BACK
       UNLINK     DRTEC,DRTEE,2,BACK
       UNLINK     DEEXC,DEEXE,2,BACK
       UNLINK     SCNTC,SCNTE,4,BACK
       UNLINK     STOFC,STOFE,1,BACK
       UNLINK     YMCSC,YMCSE,11,BACK
       UNLINK     YKCSC,YKCSE,4,BACK
       UNLINK     DRYWC,DRYWE,2,BACK
       UNLINK     AWHEC,AWHEE,2,BACK
       UNLINK     BWHEC,BWHEE,2,BACK
       UNLINK     MAINC,MAINE,8,BACK
       UNLINK     FWHEC,FWHEE,1,BACK
       UNLINK     JWHEC,JWHEE,4,BACK
       UNLINK     HVYPC,HVYPE,3,BACK
       UNLINK     LITPC,LITPE,5,BACK
       TRANSFER   FN,FTHTH             RETURN TO SIMULATION TIME CONTROL
```

```
**********************************************************************
**                   REQUISITION GENERATION                         **
** IN THIS MODULE, SPLIT BLOCKS REFERENCE VARIABLES DEFINED IN      **
** TERMS OF INPUT PARAMETERS SET BY THE USER TO GENERATE            **
** TRANSACTIONS AT THE DEMAND LEVEL SPECIFIED BY THE USER.          **
** TRANSACTIONS ARE ADVANCED INTO THE MODEL AT A UNIFORM RATE,      **
** THOUGH THE RATES ARE ADJUSTED TO MATCH REAL SYSTEM ARRIVAL       **
** CHARACTERISTICS. FOLLOWING GENERATION, REQUISITIONS ARE ASSIGNED **
** A PRIORITY MATCHING THE PARAMETER 1 ASSIGNMENT. SAVEVALUES THEN  **
** RECORD THE TOTAL NUMBER OF REQS GENERATED AND THE NUMBER         **
** IN EACH PRIORITY GROUP.                                          **
**********************************************************************
**                       NOTE:                                      **
** ENTITIES FLOWING THROUGH GPSS PROGRAMS ARE KNOWN AS TRANSACTIONS.**
** THE TERM "TRANSACTION" WILL BE USED IN THIS PROGRAM AS A GENERIC **
** TERM FOR REQUISITIONS IN ANY STAGE OF PROCESSING. IN MODULE      **
** DESCRIPTIONS AND COMMENTS, TRANSACTIONS MAY BE CALLED REQS       **
** (REQUISITIONS), ISSUE DOCS (ISSUE DOCUMENTS) OR ISSUES (AFTER    **
** WAREHOUSE PICK) AS APPROPRIATE TO THE MODULE TO CLARIFY THE      **
** PROCESS BEING MODELED. TRANSACTIONS USED IN SCHEDULE CONTROL     **
** SECTIONS WILL ALWAYS BE REFERRED TO AS CONTROL TRANSACTIONS.     **
**********************************************************************
**                       NOTE:                                      **
** GPSS QUEUE AND DEPART BLOCKS ARE PAIRED BEFORE MOST STORAGES TO  **
** GATHER QUEUE STATISTICS PROVIDED IN THE OUTPUT. SO THAT QUEUE    **
** STATISTICS REFLECT ACTUAL DEMAND LEVELS SIMULATED, ALL           **
** TRANSACTIONS JOINING AND DEPARTING QUEUES ARE COUNTED AS THREE.  **
** TRANSACTIONS ARE SPLIT AND INDIVIDUALLY QUEUED IN THE DUTY       **
** SECTION MODULE. STORAGES ARE BRACKETED BY ENTER AND LEAVE        **
** STATEMENTS TO LIMIT TRANSACTION ACCESS TO THE DEFINED CAPACITY   **
** OF THE STORAGE. BECAUSE THE PURPOSES OF THESE BLOCKS ARE STANDARD**
** THROUGHOUT THE PROGRAM, THEY WILL NOT GENERALLY BE COMMENTED.    **
**********************************************************************
*
**AM REQUISITION GENERATION (WEEKDAY)**********************************
      GENERATE   2400,,1,,,8PH        GENERATE A SINGLE TRANSACTION AT
*                                     0001 EACH DAY
      TEST E     BV$WKDAY,K1,RQTRM    TRANSFER TO NEXT BLOCK IF ON A
*                                     WORKDAY, ELSE TO RQTRM
      SPLIT      V$AMDD,AMAD          SPLIT TRANSACTION INTO THE NUMBER
*                                     OF REQS REC'D DURING WORKDAY AM
 AMAD ADVANCE    400,400              SPREAD REQUISITION FLOW UNIFORMLY
*                                     THROUGHOUT WORKDAY AM
      TRANSFER   ,PRIAS               TRANSFER ALL TO PRIAS
*
**WORKING HOURS REQUISITION GENERATION (WEEKDAY)***********************
      GENERATE   2400,,801,,,8PH      GENERATE A SINGLE TRANSACTION AT
*                                     0801 EACH DAY
      TEST E     BV$WKDAY,K1,RQTRM    TRANSFER TO NEXT BLOCK IF A
*                                     WORKDAY, ELSE TO RQTRM
      SPLIT      V$WRKDD,DAYAD        SPLIT TRANSACTION INTO THE NUMBER
*                                     OF REQS REC'D DURING WORKDAY
 DAYAD ADVANCE   437,437              SPREAD REQUISITION FLOW UNIFORMLY
*                                     THROUGHOUT WORKDAY
      TRANSFER   ,PRIAS               TRANSFER ALL TO PRIAS
*
**PM REQUISITION GENERATION (WEEKDAY)**********************************
      GENERATE   2400,,1676,,,8PH     GENERATE A SINGLE TRANSACTION AT
*                                     1646 EACH DAY
      TEST E     BV$WKDAY,K1,RQTRM    TRANSFER TO NEXT BLOCK IF ON A
*                                     WORKDAY, ELSE TO RQTRM
      SPLIT      V$PMDD,PMAD          SPLIT TRANSACTION INTO THE NUMBER
*                                     OF REQS REC'D DURING WORKDAY PM
 PMAD ADVANCE    362,362              SPREAD REQUISITION FLOW UNIFORMLY
*                                     THROUGHOUT WORKDAY PM
      TRANSFER   ,PRIAS               TRANSFER ALL TO PRIAS
```

```
**WEEKEND REQUISITION GENERATION********************************
       GENERATE   2400,,1,,,8PH        GENERATE A SINGLE TRANSACTION AT
*                                      0001 EACH DAY
       TEST E     BV$WKDAY,K0,RQTRM    TRANSFER TO NEXT BLOCK IF ON A
*                                      WEEKEND, ELSE TO RQTRM
       SPLIT      V$DDMND,WKDAD        SPLIT TRANSACTION INTO THE NUMBER
*                                      OF REQS REC'D DURING WEEKEND DAY
 WKDAD ADVANCE    1200,1200            SPREAD REQUISITION FLOW UNIFORMLY
*                                      THROUGHOUT WORKDAY PM
       TRANSFER   ,PRIAS               TRANSFER ALL TO PRIAS
*
 RQTRM TERMINATE                       TERMINATE DISCARDED TRANSACTIONS
**PRIORITY ASSIGNMENT AND STATISTICS SECTION**************************
*
 PRIAS ASSIGN     1,FN$FONE            ASSIGNMENT OF REQ PRIORITY TO P1
       PRIORITY   P1                   ASSIGNMENT OF ACTUAL TRANSACTION
*                                      PRIORITY (MATCHES P1 ASSIGN.)
       SAVEVALUE  REQCT+,1,XF          COUNTS TOTAL NO OF REQS GENERATED
       SAVEVALUE  REQCT+,1,XF          COUNTS TOTAL NO OF REQS GENERATED
       SAVEVALUE  REQCT+,1,XF          COUNTS TOTAL NO OF REQS GENERATED
       TEST NE    P1,1,CNTTH           SEND IPG3 REQS TO CNTTH, ALL
*                                      OTHERS TO NEXT BLOCK
       TEST G     P1,5,CNTTW           SEND IPG2 REQS TO CNTTW, ALL
*                                      OTHERS TO NEXT BLOCK
       SAVEVALUE  PRION+,1,XF          COUNT IPG1 REQS
       SAVEVALUE  PRION+,1,XF          COUNT IPG1 REQS
       SAVEVALUE  PRION+,1,XF          COUNT IPG1 REQS
       TRANSFER   ,RECPT               TRANSFER ALL TO RECPT
*
 CNTTW SAVEVALUE  PRITW+,1,XF          COUNT IPG2 REQS
       SAVEVALUE  PRITW+,1,XF          COUNT IPG2 REQS
       SAVEVALUE  PRITW+,1,XF          COUNT IPG2 REQS
       TRANSFER   ,RECPT               TRANSFER ALL TO RECPT
*
 CNTTH SAVEVALUE  PRITH+,1,XF          COUNT IPG3 REQS
       SAVEVALUE  PRITH+,1,XF          COUNT IPG3 REQS
       SAVEVALUE  PRITH+,1,XF          COUNT IPG3 REQS
```

```
***********************************************************************
**                  REQUISITION RECEIPT                              **
** THE SOURCE OF EACH REQ ENTERING SYSTEM IS DETERMINED. ONLINE REQS**
** ARE SENT TO THE CPU TEST MODULE, 9MP,9MB,1Q REQS TO SKCKQ FOR    **
** STOCK CHECK AND OTHER HARD COPY REQS TO THE NSD REMOTE TERMINAL   **
** ENTRY MODULE. AFTER 9MP,9MB,1Q REQS ARE STOCK CHECKED, NIS REQS   **
** ARE TERMINATED. ALL OTHERS ARE TAGGED AS IN STOCK AND SENT TO     **
** SENT TO THE NSD REMOTE TERMINAL ENTRY MODULE.                     **
***********************************************************************
**                      NOTE:                                        **
** NON-WORK HOUR TRANSACTION HANDLING IS MANAGED THROUGHOUT THE      **
** PROGRAM BY CODE SEGMENTS SIMILAR TO THAT SEPARATED BELOW BY       **
** ASTERISKS. THE FIRST THREE TEST STATEMENTS LINK TRANSACTIONS TO   **
** THE NAMED USER CHAIN  1) DURING LUNCH;  2) DURING WORKING HOURS   **
** IF THE STORAGE IS FULL;  3) AFTER WORKING HOURS EXCEPT FOR HIGH   **
** PRIORITY TRANSACTIONS (P1=4,5,6,7) WHICH ARE ASSIGNED A PROGRESS **
** PARAMETER, REMOVED FROM THE QUEUE AND TRANSFERRED TO THE DUTY     **
** SECTION MODULE. TRANSACTIONS ARE UNLINKED FROM THE USER CHAIN TO **
** THE STORAGE ENTER BLOCK AT THE BEGINNING OF THE WORKDAY AND AFTER**
** LUNCH TO INITIALLY FILL THE STORAGE. TRANSACTIONS ARE UNLINKED    **
** AT THE END OF THE WORKDAY, SO THAT HIGH PRIORITY TRANSACTIONS     **
** MAY BE TRANSFERRED TO THE DUTY SECTION MODULE (LOW PRIORITY       **
** TRANSACTIONS ARE RELINKED). FINALLY TRANSACTIONS ARE UNLINKED     **
** TO THE STORAGE ENTER BLOCK ON A ONE FOR ONE BASIS WITH            **
** TRANSACTIONS LEAVING THE STORAGE. THIS SECTION OF CODE APPEARS    **
** IN MOST MODULES CONTAINING STORAGES, AND WILL NOT BE COMMENTED    **
** ON EXCEPT AS IT DIFFERS FROM THE STANDARD FORMAT.                 **
***********************************************************************
 RECPT TRANSFER   .V$ONLIN,,NISTE      SEND ONLINE REQS TO NIS TEST,
*                                      HARD COPY REQS TO NEXT BLOCK
       TRANSFER   .V$RQDIV,,SKCKQ      SEND 1Q,9MP,9MB TO SKCKQ, ALL
*                                      OTHERS TO NEXT BLOCK
       TRANSFER   .V$GROSS,,RTETE      SEND NIS REQS TO NEXT BLOCK, ALL
*                                      OTHERS TO RTETE
       ASSIGN     6,K1                 TAG NIS REQS
       TRANSFER   ,RTETE               TRANSFER ALL TO RTETE
 SKCKQ QUEUE      QSKCK,3
**FLOW CONTROL SEGMENT**************************************************
       TEST E     BV$LUNCH,K0,SKCKL    SEND ALL TO SKCKL DURING LUNCH,
*                                      ELSE NEXT BLOCK
       TEST E     BV$WORKH,K1,SKCKT    SEND ALL TO NEXT BLOCK DURING
*                                      WORKING HOURS, ELSE SEND TO SKCKT
       TEST E     R$SKCK,K0,SKCKE      SEND ALL TO SKCKE IF STORAGE IS
*                                      NOT FULL, ELSE NEXT BLOCK
 SKCKL LINK       SKCKC,1PH            LINK TO USER CHAIN SKCKC
 SKCKT TEST GE    P1,K4,SKCKA          SEND HI PRI REQS TO NEXT BLOCK,
*                                      ALL OTHERS TO SKCKA
       ASSIGN     3,K0                 ASSIGN PROGRESS PARAMETER
       DEPART     QSKCK,3              REMOVE FROM QSKCK
       TRANSFER   ,DUTSC               SEND HI PRI REQS TO DUTSC
 SKCKA ADVANCE    1                    DUMMY
       TRANSFER   ,SKCKL               SEND ALL TO SKCKL
**END OF FLOW CONTROL SEGMENT*******************************************
 SKCKE ENTER      SKCK
 SKCKD DEPART     QSKCK,3
 SKCK  ADVANCE    V$SKCKS              STOCK CHECK ON 9MP,9MB,9Q
 SKCKV LEAVE      SKCK
       TEST E     BV$WORKH,K1,NISTR    DURING WORKING HOURS, SEND ALL TO
*                                      NEXT BLOCK, ELSE NISTR
       UNLINK     SKCKC,SKCKE,1,BACK   RELEASE ONE TRANSACTION FROM SKCKC
*
 NISTR TRANSFER   .V$GROSS,NISTM,ISTAG SEND NIS REQUISITIONS TO NISTM,
*                                      ALL OTHERS TO ISTAG
 ISTAG ASSIGN     6,K2                 TAG STOCKED CHECKED REQS
*                                      FOUND IN STOCK
       TRANSFER   ,CRTEQ               TRANSFER ALL TO CRTEQ
```

```
**********************************************************************
**                  NSD REMOTE TERMINAL ENTRY                       **
** 9MP,9MB,1Q AND ALL REQS (P1 = 3,4,5,6,7) ENTERED VIA CUST SERV   **
** RTE, REQS (P1 = 1,2) ARE ENTERED VIA DPSC RTE. NIS REQS ARE      **
** TRANSFERRED TO TERMINATION AND ALL OTHERS ARE SENT TO THE CPU    **
** CPU TEST MODULE.                                                 **
**********************************************************************
*
 RTETE TEST GE    P1,K3,DRTEQ          SEND IPG3 AND NON 1Q,9MB,9MP IPG2
*                                      REQS TO DRTEQ, ALL OTHERS TO NEXT
*                                      BLOCK
*
**CUSTOMER SERVICES REMOTE TERMINAL ENTRY*****************************
*
 CRTEQ QUEUE      QCRTE,3
       TEST E     BV$LUNCH,K0,CRTEL    SEND ALL TO CRTEL DURING LUNCH,
*                                      ELSE NEXT BLOCK
       TEST E     BV$WORKH,K1,CRTET    SEND ALL TO NEXT BLOCK DURING
*                                      WORKING HOURS, ELSE SEND TO CRTET
       TEST E     R$CRTE,K0,CRTEE      SEND ALL TO CRTEE IF STORAGE IS
*                                      NOT FULL, ELSE NEXT BLOCK
 CRTEL LINK       CRTEC,1PH            LINK TO USER CHAIN CRTEC
 CRTET TEST GE    P1,K4,CRTEA          SEND HI PRI REQS TO NEXT BLOCK,
*                                      ALL OTHERS TO CRTEA
       ASSIGN     3,K1                 ASSIGN PROGRESS PARAMETER
       DEPART     QCRTE,3              REMOVE FROM QCRTE
       TRANSFER   ,DUTSC               SEND HI PRI REQS TO DUTSC
 CRTEA ADVANCE    1                    DUMMY
       TRANSFER   ,CRTEL               SEND ALL TO CRTEL
 CRTEE ENTER      CRTE
       DEPART     QCRTE,3
 CRTE  ADVANCE    V$RTES               ENTER REQS VIA CUST SERV RTE
       LEAVE      CRTE
       TEST E     BV$WORKH,K1,CSTR
       UNLINK     CRTEC,CRTEE,1,BACK   RELEASE ONE TRANSACTION FROM CTWO
*
 CSTR  TEST E     P6,1,PRTE            SEND NIS REQS TO NEXT BLOCK, ALL
*                                      OTHER TO PRTE
       TRANSFER   ,NISTM               TRANSFER NIS REQS TO NISTM
*
**DPSC REMOTE TERMINAL ENTRY*******************************************
*
 DRTEQ QUEUE      QDRTE,3
       TEST E     BV$WORKH,K1,DRTEL    SEND ALL TO NEXT BLOCK DURING
*                                      WORKING HOURS, ELSE SEND TO DRTEL
       TEST E     R$DRTE,K0,DRTEE      SEND ALL TO DRTEE IF STORAGE IS
*                                      NOT FULL, ELSE NEXT BLOCK
 DRTEL LINK       DRTEC,1PH            LINK TO USER CHAIN DRTEC
 DRTEE ENTER      DRTE
       DEPART     QDRTE,3
 DRTE  ADVANCE    V$RTES               ENTER REQS VIA DPSC RTE
       LEAVE      DRTE
       TEST E     BV$WORKH,K1,DPTE
       UNLINK     DRTEC,DRTEE,1,BACK   RELEASE ONE TRANSACTION FROM DRTEC
*
 DPTE  TEST E     P6,1,PRTE            SEND NIS REQS TO NEXT BLOCK, ALL
*                                      OTHER TO PRINTER TEST
       TRANSFER   ,NISTM               TRANSFER NIS REQS TO NISTM
```

```
**********************************************************************
**                           CPU TESTS                              **
** TEST FOR, PROCESS AND RE-ENTER DEMAND EXCEPTIONS. TEST FOR AND   **
** TRANSFER ONLINE NIS REQS. ROUTE IPG3 AND NON 9MP,9MB,9MF AND  1Q **
** IPG2 REQS TO STOR CONT PRINTER, BALANCE TO CUST SERV PRINTER IN  **
** THE PRINTER QUEUE HANDLING MODULE.                               **
**********************************************************************
*
 NISTE TRANSFER   .V$GROSS,NISTM,PRTE  SEND NIS REQS TO NISTM, ALL
*                                      OTHERS TO PRTE
*
 PRTE  TEST L     P1,K3,CSPRQ          SEND REQS (P1 = 3,4,5,6,7) TO
*                                      CSPRQ, ALL OTHERS TO NEXT BLOCK
*
       TRANSFER   .V$PROV,SCPRQ,CSPRQ  SEND 9MF,9MP,9MB,1Q REQS TO
*                                      CSPRQ, ALL OTHERS TO SCPRQ
```

```
**********************************************************************
**             PRINTER QUEUE HANDLING                               **
** LINK IPG3 REQS ON USER CHAIN THREE, UNLINK THEM TO PRINT ISSUE   **
** DOCUMENTS IN STORAGE CONTROL AT 0800 ON WORKDAYS. LINK IPG2 REQS **
** ON USER CHAIN TWO, UNLINK THEM TO PRINT ISSUE DOCUMENTS IN       **
** STORAGE CONTROL AT 0800,1000,1245,1445 ON WORKDAYS. LINK ALL     **
** IPG1,BWT,CASREPT,QUICK PICK,9MF,9MP,9MB,1Q REQS ON USER CHAIN    **
** ONE, UNLINK TO PRINT  ISSUE DOCUMENTS ON THE CUST SERV PRINTER   **
** EVERY FIVE MINUTES. ALL ISSUE DOCS PRINTED ALL SENT TO THE       **
** DEMAND EXCEPTION HANDLING MODULE. PRINTER OPERATIONS ARE         **
** MODELED BY THE CONTROL TRANSACTION IN THE PARTIONED SCHEDULE     **
** CONTROL SECTION.                                                 **
**********************************************************************
*
**PRINTER CONTROL SECTION*********************************************
*
       GENERATE   25                   GENERATE CONTROL TRANSACTION TO
*                                      TRIGGER PRINTER EVERY 15 MIN
*
       UNLINK     THREE,SCPRE,ALL,BV$PRTHR
*                                      SEND ALL REQS ON USER CHAIN THREE
*                                      TO THE STORAGE CONTROL PRINTER
*
       UNLINK     TWO,SCPRE,ALL,BV$PRTWO
*                                      SEND ALL REQS ON USER CHAIN TWO
*                                      TO THE STORAGE CONTROL PRINTER
*
       TERMINATE                       TERMINATE CONTROL TRANSACTION
*
       GENERATE   5                    GENERATE CONTROL TRANSACTION TO
*                                      TRIGGER CUST SERV PRINTER EVERY
*                                      5 MINUTES
*
 UNLNK UNLINK     ONE,CSPRE,ALL,BACK   SEND ALL REQS ON USER CHAIN ONE
*                                      TO THE CUST SERV PRINTER
*
       TERMINATE                       TERMINATE CONTROL TRANSACTION
*
**STORAGE CONTROL PRINTER OPERATIONS SECTION**************************
*
 SCPRQ QUEUE      QSCPR,3              ENTER STORAGE CONT PRINTER QUEUE
*
       TEST E     P1,K1,LKTWO          SEND IPG2 REQS TO LKTWO,
*                                      IPG3 TO NEXT BLOCK
*
       LINK       THREE,1PH            LINK IPG3 ON USER CHAIN THREE
 LKTWO LINK       TWO,1PH              LINK IPG2 ON USER CHAIN TWO
*
 SCPRE ENTER      SCPR
       DEPART     QSCPR,3              DEPART QUEUE
 SCPR  ADVANCE                         PRINT ISSUE DOCS
       LEAVE      SCPR
*
       TRANSFER   ,DEXTE               TRANSFER ALL TO DEXTE
*
**CUSTOMER SERVICES PRINTER OPERATIONS SECTION************************
*
 CSPRQ QUEUE      QCSPR,3              ENTER CUST SERV PRINTER QUEUE
*
       LINK       ONE,1PH              LINK ALL TO USER CHAIN ONE
*
 CSPRE ENTER      CSPR
       DEPART     QCSPR,3              DEPART QUEUE
 CSPR  ADVANCE                         PRINT ISSUE DOCS
       LEAVE      CSPR
```

```
**********************************************************************
**               DEMAND EXCEPTION HANDLING                          **
** TRANSACTIONS ARE RECEIVED FROM THE PRINTER QUEUE HANDLING MODULE **
** AND THE WAREHOUSE MODULE. PREVIOUSLY PROCESSED DEMAND EXCEPTIONS **
** ARE SENT TO THE WAREHOUSE ASSIGNMENT MODULE, WAREHOUSE REFUSALS  **
** ARE PROCESSED AS SUCH AND TERMINATED. NEW DEMAND EXCEPTIONS ARE  **
** PROCESSED, TAGGED AS COMPLETED AND SENT BACK TO THE PRINTER      **
** QUEUE HANDLING MODULE. TRANSACTIONS NOT RESULTING IN DEMAND      **
** EXCEPTIONS ARE SENT DIRECTLY TO THE WAREHOUSE ASSIGNMENT MODULE. **
**********************************************************************
*
 DEXTE TEST NE    P7,K1,LOCAS          SEND PROCESSED DEMAND EXCEPTIONS
*                                      TO LOCAS, OTHERS TO NEXT BLOCK
       TRANSFER   .V$NOTEX,,LOCAS      SEND REQS WITH DEMAND EXCEPTIONS
*                                      TO NEXT BLOCK, SEND OTHERS TO
*                                      LOCAS
 DEEXQ QUEUE      QDEEX,3
       TEST E     BV$LUNCH,K0,DEEXL    SEND ALL TO DEEXL DURING LUNCH,
*                                      ELSE NEXT BLOCK
       TEST E     BV$WORKH,K1,DEEXT    SEND ALL TO NEXT BLOCK DURING
*                                      WORKING HOURS, ELSE SEND TO DEEXT
       TEST E     R$DEEX,K0,DEEXE      SEND ALL TO DEEXE IF STORAGE IS
*                                      NOT FULL, ELSE NEXT BLOCK
 DEEXL LINK       DEEXC,1PH            LINK TO USER CHAIN DEEXC
 DEEXT TEST GE    P1,K4,DEEXA          SEND HI PRI REQS TO NEXT BLOCK,
*                                      ALL OTHERS TO DEEXA
       TEST NE    P8,K1,DEEXA          SEND WAREHOUSE REFUSALS TO DEEXA,
*                                      ALL OTHERS TO NEXT BLOCK
       ASSIGN     3,K3                 ASSIGN PROGRESS PARAMETER
       DEPART     QDEEX,3              REMOVE FROM QDEEX
       TRANSFER   ,DUTSC               SEND HI PRI REQS TO DUTSC
 DEEXA ADVANCE    1                    DUMMY
       TRANSFER   ,DEEXL               SEND ALL TO DEEXL
 DEEXE ENTER      DEEX
       DEPART     QDEEX,3              REMOVE FROM USER CHAIN QDEEX
 DEEX  ADVANCE    V$DEEXS              PROCESS DEMAND EXCEPT./WAR. REF.
       LEAVE      DEEX
       ASSIGN     7,K1                 TAG PROCESSED DEMAND EXCEPTIONS
       TEST E     BV$WORKH,K1,WRTE     DURING WORKING HOURS SEND ALL TO
*                                      NEXT BLOCK, ELSE WRTE
       UNLINK     DEEXC,DEEXE,K1,BACK  RELEASE ONE TRANSACTION FROM DEEXC
 WRTE  TEST E     P8,K1,PRTE           SEND WAREHOUSE REFUSALS TO NEXT
*                                      BLOCK, ALL OTHERS TO PRTE
*
       TRANSFER   ,WRTRM               TRANSFER ALL TO WRTRM
```

```
**********************************************************************
**             WAREHOUSE ASSIGNMENT MODULE                          **
** ALL ISSUE DOCUMENTS ARE ASSIGNED A WAREHOUSE LOCATION. THOSE     **
** ISSUE DOCUMENTS IDENTIFIED AS WAREHOUSE REFUSALS ARE TAGGED AS   **
** SUCH. BEARER WALKTHROUGH ISSUE DOCS ARE TAGGED AND ARE           **
** TRANSFERRED TO THE WAREHOUSE MODULE WITH A DELAY ASSIGNED BY     **
** LOCATION. ALL OTHER ISSUE DOCUMENTS ARE SENT TO THE STORAGE      **
** OFFICE/STORAGE CONTROL MODULE.                                   **
**********************************************************************
*
 LOCAS ASSIGN     2,FN$FTWO            ASSIGN WAREHOUSE LOCATION TO P2
*
       TRANSFER   .V$NOTWR,,DESTE      SEND WAREHOUSE REFUSALS TO NEXT
*                                      BLOCK, ALL OTHERS TO DESTE
       ASSIGN     8,K1                 TAG WAREHOUSE REFUSALS
*
 DESTE TEST NE    P1,K5,BWTAD          SEND IPG2 BWT TO BWTAD,
*                                      ALL OTHERS TO NEXT BLOCK
*
       TEST NE    P1,K7,BWTAD          SEND IPG1 BWT TO BWTAD,
*                                      ALL OTHERS TO NEXT BLOCK
*
       TEST G     P2,K3,STOFQ          SEND PROV. REQS TO STORAGE OFF,
*                                      ALL OTHERS TO NEXT BLOCK
*
       TRANSFER   ,SCNTQ               TRANSFER ALL TO SCNTQ
*
 BWTAD ADVANCE    FN$FTHSV             DELAY TO SIMULATE BEARER
*                                      TRANSPORTATION TO THE WAREHOUSE
*
       TRANSFER   FN,FTHTW             SENT ALL TO RESPECTIVE WAREHOUSE
*
```

```
**********************************************************************
**          STORAGE CONTROL/STORAGE OFFICE                          **
** PROVISIONS ISSUE DOCUMENTS ENTER AT STOFQ, ALL OTHERS AT SCNTQ.  **
** ISSUE DOCUMENTS ARE MARKED, BURST AND SORTED BY LOCATION. ALL    **
** ISSUE DOCUMENTS EXCEPT THOSE BOUND FOR YOKOHAMA COLD STORAGE ARE **
** SENT TO THE BIKE MESSENGER DELIVERY MODULE. YOKOHAMA ISSUE DOCS  **
** ARE SENT TO THE YOKOHAMA ISSUE DOCUMENT DELIVERY MODULE.         **
**********************************************************************
*
**STORAGE CONTROL SECTION*********************************************
*
 SCNTQ QUEUE      QSCNT,3
       TEST E     BV$LUNCH,K0,SCNTL    SEND ALL TO SCNTL DURING LUNCH,
*                                      ELSE NEXT BLOCK
       TEST E     BV$WORKH,K1,SCNTT    SEND ALL TO NEXT BLOCK DURING
*                                      WORKING HOURS, ELSE SEND TO SCNTT
       TEST E     R$SCNT,K0,SCNTE      SEND ALL TO SCNTE IF STORAGE IS
*                                      NOT FULL, ELSE NEXT BLOCK
 SCNTL LINK       SCNTC,1PH            LINK TO USER CHAIN SCNTC
 SCNTT TEST GE    P1,K4,SCNTA          SEND HI PRI REQS TO NEXT BLOCK,
*                                      ALL OTHERS TO SCNTA
       ASSIGN     3,K4                 ASSIGN PROGRESS PARAMETER
       DEPART     QSCNT,3              REMOVE FROM QSCNT
       TRANSFER   ,DUTSC               SEND HI PRI REQS TO DUTSC
 SCNTA ADVANCE    1                    DUMMY
       TRANSFER   ,SCNTL               SEND ALL TO SCNTL
 SCNTE ENTER      SCNT
       DEPART     QSCNT,3
 SCNT  ADVANCE    V$SCSOS              MARK,BURST,SORT ISSUE DOCS
       LEAVE      SCNT
       TEST E     BV$WORKH,K1,SCTE     DURING WORKING HOURS SEND ALL TO
*                                      NEXT BLOCK, ELSE TO SCTE
       UNLINK     SCNTC,SCNTE,1,BACK   RELEASE ONE TRANSACTION FROM SCNTC
*
 SCTE  TRANSFER   ,BIKEQ               SEND ALL TO BIKEQ
*
**STORAGE OFFICE SECTION*********************************************
*
 STOFQ QUEUE      QSTOF,3
       TEST E     BV$LUNCH,K0,STOFL    SEND ALL TO STOFL DURING LUNCH,
*                                      ELSE NEXT BLOCK
       TEST E     BV$WORKH,K1,STOFT    SEND ALL TO NEXT BLOCK DURING
*                                      WORKING HOURS, ELSE SEND TO STOFT
       TEST E     R$STOF,K0,STOFE      SEND ALL TO STOFE IF STORAGE IS
*                                      NOT FULL, ELSE NEXT BLOCK
 STOFL LINK       STOFC,1PH            LINK TO USER CHAIN STOFC
 STOFT TEST GE    P1,K4,STOFA          SEND HI PRI REQS TO NEXT BLOCK,
*                                      ALL OTHERS TO STOFA
       ASSIGN     3,K5                 ASSIGN PROGRESS PARAMETER
       DEPART     QSTOF,3              REMOVE FROM QSTOF
       TRANSFER   ,DUTSC               SEND HI PRI REQS TO DUTSC
 STOFA ADVANCE    1                    DUMMY
       TRANSFER   ,STOFL               SEND ALL TO STOFL
 STOFE ENTER      STOF
       DEPART     QSTOF,3              REMOVE FROM QSTOF
 STOF  ADVANCE    V$SCSOS              MARK,BURST,SORT ISSUE DOCS
       LEAVE      STOF
       TEST E     BV$WORKH,K1,SOTE     DURING WORKING HOURS SEND ALL TO
*                                      NEXT BLOCK, ELSE TO SOTE
       UNLINK     STOFC,STOFE,1,BACK   RELEASE ONE TRANSACTION FROM STOFC
*
 SOTE  TEST E     P2,K1,BIKEQ          SEND YOKOHAMA CS DOCS TO NEXT
*                                      BLOCK, SEND ALL OTHERS TO BIKEQ
*
       TRANSFER   ,DLVRT               SEND ALL TO DLVRT
```

```
**********************************************************************
**        YOKOHAMA ISSUE DOCUMENT DELIVERY                          **
** DELIVERY OF ISSUE DOCUMENTS BY PICKUP TRUCK IS SIMULATED IN THIS **
** MODULE. ISSUE DOCS ARRIVING ARE PLACED ON USER CHAIN DLVRC WHICH **
** IS UNLINKED TO YMCSQ WITH AN APPROPRIATE TIME DELAY AT 0830 ON   **
** WORKDAYS. BECAUSE DURING ACTUAL OPERATIONS, HIGH PRIORITY ISSUE  **
** DOCUMENTS ARRIVING AFTER 0830 ARE NOT DELAYED UNTIL THE NEXT DAY,**
** THOSE HIGH PRIORITY DOCUMENTS ARRIVING DURING THE WORKDAY AFTER  **
** 0830 ARE TRANSFERRED DIRECTLY TO YMCSQ TO AVOID UNREALISTIC      **
** DELAYS ON THE DLVRC USER CHAIN. HIGH PRIORITY ISSUE DOCUMENTS    **
** ARRIVING AFTER WORKING HOURS OR ON WEEKENDS ARE TRANSFERRED TO   **
** THE DUTY SECTION MODULE. PICKUP DELIVERY OPERATION SCHEDULING IS **
** CONTROLLED BY THE PARTIONED SCHEDULE CONTROL SECTION.            **
**********************************************************************
*
**SCHEDULE CONTROL SECTION*********************************************
*
       GENERATE   2400,,850            GENERATE CONTROL TRANSACTION TO
*                                      TRIGGER YOKOHAMA DELIVERY
       UNLINK     DLVRC,DLVRE,ALL,BV$WKDAY
*                                      SEND ISSUE DOCS ON DELIVER USER
*                                      CHAIN TO DLVRE
*
       TERMINATE                       TERMINATE CONTROL TRANSACTION
*
**OPERATIONS SECTION**************************************************
*
 DLVRT TEST G     P1,K3,DLVRQ          SEND LOW PRI ISSUE DOCS TO DLVRQ,
*                                      ALL OTHERS TO NEXT BLOCK
       TEST E     BV$OPEN,K1,DLVTR     IF OUTSIDE OF DEPOT WORKING HOURS,
*                                      SEND TO DLVTR, ELSE NEXT BLOCK
       TEST G     V$TIME,K0850,DLVRQ   IF AFTER DAILY RUN, SEND TO NEXT
*                                      BLOCK, ELSE DLVRQ
       TRANSFER   ,YMCSQ               TRANSFER ALL TO YMCSQ
*
 DLVTR ASSIGN     3,K6                 ASSIGN PROGRESS PARAMETER
       TRANSFER   ,DUTSC               SEND ALL TO DUTSC
*
 DLVRQ QUEUE      QDLVR,3              ENTER QUEUE FOR REQ DELIVERY
*                                      TO YOKOHAMA CS
*
 DLVRL LINK       DLVRC,1PH            WAIT ON USER CHAIN DLVRC
*
 DLVRE ENTER      DLVR
       DEPART     QDLVR,3              DEPART QUEUE
 DLVR  ADVANCE    150,50               DELIVERY TO YOKOHAMA
       LEAVE      DLVR
*
       TRANSFER   ,YMCSQ               TRANSFER ALL TO YOKOHAMA COLD
*                                      STORAGE QUEUE
```

```
*********************************************************************
**                   BICYCLE MESSENGER DELIVERY                     **
** THIS MODULE DELIVERS ISSUE DOCUMENTS TO WAREHOUSE LOCATIONS BY   **
** BICYCLE MESSENGER AT 0900,1100,1345 AND 1515 ON WORKDAYS. HIGH   **
** PRIORITY REQS ARRIVING DURING WORKING HOURS AFTER THE LAST RUN   **
** ARE TRANSFERRED TO THE WAREHOUSE MODULE DIRECTLY TO SIMULATE     **
** DELIVERY BY OFFICE PERSONNEL IN ACCORDANCE WITH ACTUAL           **
** PROCEDURES. THE SCHEDULE CONTROL SECTION IS PARTIONED IN THE     **
** TOP HALF OF THE MODULE.                                          **
*********************************************************************
*
**SCHEDULE CONTROL SECTION*******************************************
*
      GENERATE   25                       GENERATE CONTROL TRANSACTION TO
*                                         TRIGGER PRINTER EVERY 15 MIN
*
      UNLINK     BIKEC,BIKEE,ALL,BV$DTIME
*                                         SEND ALL ISSUE DOCS ON USER CHAIN
*                                         BIKEC TO BIKEQ
*
      TERMINATE                           TERMINATE CONTROL TRANSACTION
*
**OPERATIONS SECTION*************************************************
*
 BIKEQ QUEUE     QBIKE,3
      TEST GE    P1,K4,BIKEL              SEND LOW PRI REQS TO BIKEL,
*                                         ALL OTHERS TO NEXT BLOCK
      TEST G     V$TIME,K1525,BIKEL       IF BEFORE LAST MESSENGER RUN, SEND
*                                         ALL TO BIKEL, ELSE NEXT BLOCK
      TEST L     V$TIME,K1676,BIKTR       IF DURING WORKING HOURS SEND TO
*                                         NEXT BLOCK, ELSE BIKTR
*
      DEPART     QBIKE,3
      ADVANCE    FN$FTHSV                 OFFICE PERSONNEL DELIVER
      TRANSFER   ,WHTR                    SEND HI PRI REQS TO WHTR
*
 BIKTR DEPART    QBIKE,3
      ASSIGN     3,K7                     ASSIGN PROGRESS PARAMETER
      TRANSFER   ,DUTSC                   SEND HI PRI REQS TO DUTSC
*
 BIKEL LINK      BIKEC,1PH                LINK ALL ISSUE DOCUMENTS AWAITING
*                                         TRANSPORTATION TO BIKEC
*
 BIKEE ENTER     BIKE
      DEPART     QBIKE,3
 BIKE  ADVANCE   FN$FTHSX                 DELIVER ISSUE DOCS TO WAREHOUSES
      LEAVE      BIKE
```

```
**********************************************************************
**                     WAREHOUSES                                   **
** ISSUE DOCUMENTS ARE SENT TO THE WAREHOUSE INDICATED BY P2.       **
** PICKING, STAGING AND SHIPMENT PREPARATION (PROVISIONS WAREHOUSES **
** ONLY) FUNCTIONS ARE SIMULATED. WAREHOUSE REFUSALS ARE TRANSFERRED**
** TO THE DEMAND EXCEPTION MODULE FOR PROCESSING. BWT AND QUICK     **
** PICK ISSUES ARE TRANSFERRED TO TERMINATION AS WELL AS ISSUES     **
** MADE AVAILABLE FOR SHIPMENT DIRECTLY FROM PROVISIONS WAREHOUSES. **
** ISSUES FROM YOKOSUKA COLD STORAGE AND B-47 REQUIRING PACKING     **
** OR SHIPMENT FROM THE FREIGHT TERMINAL ARE TRANSFERRED TO THE     **
** PROVISIONS TRACTOR TRAIN MODULE. ALL OTHER ISSUES FROM GENERAL   **
** STORAGE LOCATIONS ARE SENT TO THE TRACTOR TRAIN DELIVERY MODULE. **
** WAREHOUSE SUBMODULES ARE PARTIONED AND LABELED.                  **
**********************************************************************
*
 WHTR  TRANSFER   FN,FTHTW             TRANSFER ISSUE DOCS TO STORAGE
*                                      LOCATION
*
*YOKOHAMA COLD STORAGE***************************************************
*
 YMCSQ QUEUE      QYMCS,3
       TEST E     BV$LUNCH,K0,YMCSL    SEND ALL TO YMCSL DURING LUNCH,
*                                      ELSE NEXT BLOCK
       TEST E     BV$WORKH,K1,YMCST    SEND ALL TO NEXT BLOCK DURING
*                                      WORKING HOURS, ELSE SEND TO YMCST
       TEST E     R$YMCS,K0,YMCSE      SEND ALL TO YMCSE IF STORAGE IS
*                                      NOT FULL, ELSE NEXT BLOCK
 YMCSL LINK       YMCSC,1PH            LINK TO USER CHAIN YMCSC
 YMCST TEST GE    P1,K4,YMCSA          SEND HI PRI REQS TO NEXT BLOCK,
*                                      ALL OTHERS TO YMCSA
       ASSIGN     3,K8                 ASSIGN PROGRESS PARAMETER
       DEPART     QYMCS,3              REMOVE FROM QYMCS
       TRANSFER   ,DUTSC               SEND HI PRI REQS TO DUTSC
 YMCSA ADVANCE    1                    DUMMY
       TRANSFER   ,YMCSL               SEND ALL TO YMCSL
 YMCSE ENTER      YMCS
       DEPART     QYMCS,3
 YMCS  ADVANCE    V$YMCSS              PICK, PREPARE FOR SHIP AND STAGE
       LEAVE      YMCS
       TEST E     BV$WORKH,K1,YMTE     DURING WORKING HOURS SEND ALL TO
*                                      NEXT BLOCK, ELSE TO YMTE
       UNLINK     YMCSC,YMCSE,1,BACK   RELEASE ONE TRANSACTION FROM YMCSC
*
 YMTE  TEST NE    P8,K1,DEEXQ          SEND WAREHOUSE REFUSALS TO
*                                      EXCEPTION HANDLING
*
       TRANSFER   ,TERM                TERMINATE REQS AVAILABLE FOR
*                                      SHIPMENT
```

```
**YOKOSUKA COLD STORAGE**************************************************
 YKCSQ QUEUE      QYKCS,3
       TEST E     BV$LUNCH,K0,YKCSL     SEND ALL TO YKCSL DURING LUNCH,
*                                       ELSE NEXT BLOCK
       TEST E     BV$WORKH,K1,YKCST     SEND ALL TO NEXT BLOCK DURING
*                                       WORKING HOURS, ELSE SEND TO YMCST
       TEST E     R$YKCS,K0,YKCSE       SEND ALL TO YKCSE IF STORAGE IS
*                                       NOT FULL, ELSE NEXT BLOCK
 YKCSL LINK       YKCSC,1PH             LINK TO USER CHAIN YKCSC
 YKCST TEST GE    P1,K4,YKCSA           SEND HI PRI REQS TO NEXT BLOCK,
*                                       ALL OTHERS TO YKCSA
       ASSIGN     3,K9                  ASSIGN PROGRESS PARAMETER
       DEPART     QYKCS,3               REMOVE FROM QYKCS
       TRANSFER   ,DUTSC                SEND HI PRI REQS TO DUTSC
 YKCSA ADVANCE    1                     DUMMY
       TRANSFER   ,YKCSL                SEND ALL TO YKCSL
 YKCSE ENTER      YKCS
       DEPART     QYKCS,3
 YKCS  ADVANCE    V$YKCSS               PICK AND STAGE MATERIAL
       LEAVE      YKCS
       TEST E     BV$WORKH,K1,YKTE      DURING WORKING HOURS SEND ALL TO
*                                       NEXT BLOCK, ELSE TO YKTE
       UNLINK     YKCSC,YKCSE,1,BACK    RELEASE ONE TRANSACTION FROM YKCSC
*
 YKTE  TEST NE    P8,K1,DEEXQ           SEND WAREHOUSE REFUSALS TO
*                                       EXCEPTION HANDLING
*
       TEST E     BV$BEAR,K0,TERM       SEND BEARER ISSUES TO TERM,
*                                       ALL OTHERS TO NEXT BLOCK
*
       ASSIGN     4,FN$FFOUR            ASSIGN ISSUE DESTINATIONS TO P4
*
       ASSIGN     5,V$YKCSW             ASSIGN ISSUE WEIGHT
*
       TEST NE    P4,K1,TERM            SEND ISSUES FOR PACKING OR FREIGHT
*                                       TERMINAL SECTION TO NEXT BLOCK,
*                                       ALL OTHERS TO TERM
*
       TRANSFER   ,PTRNQ                TRANSFER ALL TO PTRNQ
```

```
**B-47 (DRY PROVISIONS)**************************************************
 DRYWQ QUEUE      QDRYW,3
       TEST E     BV$LUNCH,K0,DRYWL    SEND ALL TO DRYWL DURING LUNCH,
*                                      ELSE NEXT BLOCK
       TEST E     BV$WORKH,K1,DRYWT    SEND ALL TO NEXT BLOCK DURING
*                                      WORKING HOURS, ELSE SEND TO DRYWT
       TEST E     R$DRYW,K0,DRYWE      SEND ALL TO DRYWE IF STORAGE IS
*                                      NOT FULL, ELSE NEXT BLOCK
 DRYWL LINK       DRYWC,1PH            LINK TO USER CHAIN DRYWC
 DRYWT TEST GE    P1,K4,DRYWA          SEND HI PRI REQS TO NEXT BLOCK,
*                                      ALL OTHERS TO DRYWA
       ASSIGN     3,K10                ASSIGN PROGRESS PARAMETER
       DEPART     QDRYW,3              REMOVE FROM QDRYW
       TRANSFER   ,DUTSC               SEND HI PRI REQS TO DUTSC
 DRYWA ADVANCE    1                    DUMMY
       TRANSFER   ,DRYWL               SEND ALL TO DRYWL
 DRYWE ENTER      DRYW
       DEPART     QDRYW,3
 DRYW  ADVANCE    V$DRYWS              PICK AND STAGE MATERIAL
       LEAVE      DRYW
       TEST E     BV$WORKH,K1,DRYT     DURING WORKING HOURS SEND ALL TO
*                                      NEXT BLOCK, ELSE TO DRYT
       UNLINK     DRYWC,DRYWE,1,BACK   RELEASE ONE TRANSACTION FROM DRYWC
*
 DRYT  TEST NE    P8,K1,DEEXQ          SEND WAREHOUSE REFUSALS TO
*                                      EXCEPTION HANDLING
*
       TEST E     BV$BEAR,K0,TERM      SEND BEARER ISSUES TO TERM, ALL
*                                      OTHERS TO NEXT BLOCK
*
       ASSIGN     4,FN$FFIVE           ASSIGN ISSUE DESTINATION
*
       ASSIGN     5,V$DRYWW            ASSIGN ISSUE WEIGHT
*
       TEST NE    P4,K1,TERM           SEND ISSUES FOR PACKING OR FREIGHT
*                                      TERMINAL SECTION TO NEXT BLOCK,
*                                      ALL OTHERS TO TERM
*
       TRANSFER   ,PTRNQ               TRANSFER ALL TO PTRNQ
```

```
*A WAREHOUSE AREA (A-19)*************************************************
 AWHEQ QUEUE      QAWHE,3
       TEST E     BV$LUNCH,K0,AWHEL    SEND ALL TO AWHEL DURING LUNCH,
*                                      ELSE NEXT BLOCK
       TEST E     BV$WORKH,K1,AWHET    SEND ALL TO NEXT BLOCK DURING
*                                      WORKING HOURS, ELSE SEND TO AWHET
       TEST E     R$AWHE,K0,AWHEE      SEND ALL TO AWHEE IF STORAGE IS
*                                      NOT FULL, ELSE NEXT BLOCK
 AWHEL LINK       AWHEC,1PH            LINK TO USER CHAIN AWHEC
 AWHET TEST GE    P1,K4,AWHEA          SEND HI PRI REQS TO NEXT BLOCK,
*                                      ALL OTHERS TO AWHEA
       ASSIGN     3,K11                ASSIGN PROGRESS PARAMETER
       DEPART     QAWHE,3              REMOVE FROM QAWHE
       TRANSFER   ,DUTSC               SEND HI PRI REQS TO DUTSC
 AWHEA ADVANCE    1                    DUMMY
       TRANSFER   ,AWHEL               SEND ALL TO AWHEL
 AWHEE ENTER      AWHE
       DEPART     QAWHE,3
 AWHE  ADVANCE    V$AWHES              PICK AND BIN MATERIAL
       LEAVE      AWHE
       TEST E     BV$WORKH,K1,AWHT     DURING WORKING HOURS SEND ALL TO
*                                      NEXT BLOCK, ELSE TO AWHT
       UNLINK     AWHEC,AWHEE,1,BACK   RELEASE ONE TRANSACTION FROM AWHEC
*
 AWHT  TEST NE    P8,K1,DEEXQ          SEND WAREHOUSE REFUSALS TO
*                                      EXCEPTION HANDLING
*
       TEST E     BV$BEAR,K0,TERM      SEND BEARER ISSUES TO TERM, ALL
*                                      OTHERS TO NEXT BLOCK
*
       ASSIGN     4,FN$FSIX            ASSIGN ISSUE DESTINATION
       ASSIGN     5,V$AWHEW            ASSIGN ISSUE WEIGHT
*
       TEST G     V$TIME,1450,AQUE     IF LAST TRACTOR TRAIN OF DAY HAS
*                                      DEPARTED, SEND TO NEXT BLOCK, ELSE
*                                      AQUE
       TEST GE    P1,K4,AQUE           SEND HI PRI REQS TO NEXT BLOCK,
*                                      ALL OTHERS TO AQUE
*
       ASSIGN     3,K17                ASSIGN PROGRESS PARAMETER
*
       TRANSFER   ,DUTSC               TRANSFER ALL TO DUTSC
*
 AQUE  QUEUE      QBTRN,3
 ALINK LINK       ACH,1PH              PLACE TRANSACTIONS ON A USER CHAIN
*                                      AWAITING ON-BASE TRANSPORTATION
```

```
**B WAREHOUSE AREA (B-34,B-45,B-46)*************************************
 BWHEQ QUEUE      QBWHE,3
       TEST E     BV$LUNCH,K0,BWHEL    SEND ALL TO BWHEL DURING LUNCH,
*                                      ELSE NEXT BLOCK
       TEST E     BV$WORKH,K1,BWHET    SEND ALL TO NEXT BLOCK DURING
*                                      WORKING HOURS, ELSE SEND TO BWHET
       TEST E     R$BWHE,K0,BWHEE      SEND ALL TO BWHEE IF STORAGE IS
*                                      NOT FULL, ELSE NEXT BLOCK
 BWHEL LINK       BWHEC,1PH            LINK TO USER CHAIN BWHEC
 BWHET TEST GE    P1,K4,BWHEA          SEND HI PRI REQS TO NEXT BLOCK,
*                                      ALL OTHERS TO BWHEA
       ASSIGN     3,K12                ASSIGN PROGRESS PARAMETER
       DEPART     QBWHE,3              REMOVE FROM QBWHE
       TRANSFER   ,DUTSC               SEND HI PRI REQS TO DUTSC
 BWHEA ADVANCE    1                    DUMMY
       TRANSFER   ,BWHEL               SEND ALL TO BWHEL
 BWHEE ENTER      BWHE
       DEPART     QBWHE,3
 BWHE  ADVANCE    V$BWHES              PICK AND STAGE MATERIAL
       LEAVE      BWHE
       TEST E     BV$WORKH,K1,BWHT     DURING WORKING HOURS SEND ALL TO
*                                      NEXT BLOCK, ELSE TO BWHT
       UNLINK     BWHEC,BWHEE,1,BACK   RELEASE ONE TRANSACTION FROM BWHEC
*
 BWHT  TEST NE    P8,K1,DEEXQ          SEND WAREHOUSE REFUSALS TO
*                                      EXCEPTION HANDLING
*
       TEST E     BV$BEAR,K0,TERM      SEND BEARER ISSUES TO TERM, ALL
*                                      OTHERS TO NEXT BLOCK
*
       ASSIGN     4,FN$FSEVE           ASSIGN ISSUE DESTINATION
       ASSIGN     5,V$BWHEW            ASSIGN ISSUE WEIGHT
*
       TEST G     V$TIME,1433,BQUE     IF LAST TRACTOR TRAIN OF DAY HAS
*                                      DEPARTED, SEND TO NEXT BLOCK, ELSE
*                                      BQUE
       TEST GE    P1,K4,BQUE           SEND HI PRI REQS TO NEXT BLOCK,
*                                      ALL OTHERS TO BQUE
*
       ASSIGN     3,K18                ASSIGN PROGRESS PARAMETER
*
       TRANSFER   ,DUTSC               TRANSFER ALL TO DUTSC
*
 BQUE  QUEUE      QBTRN,3
 BLINK LINK       BCH,1PH              PLACE TRANSACTIONS ON A USER CHAIN
*                                      AWAITING ON-BASE TRANSPORTATION
```

```
**F-157******************************************************************
 MAINQ QUEUE      QMAIN,3
       TEST E     BV$LUNCH,K0,MAINL    SEND ALL TO MAINL DURING LUNCH,
*                                      ELSE NEXT BLOCK
       TEST E     BV$WORKH,K1,MAINT    SEND ALL TO NEXT BLOCK DURING
*                                      WORKING HOURS, ELSE SEND TO MAINT
       TEST E     R$MAIN,K0,MAINE      SEND ALL TO MAINE IF STORAGE IS
*                                      NOT FULL, ELSE NEXT BLOCK
 MAINL LINK       MAINC,1PH            LINK TO USER CHAIN MAINC
 MAINT TEST GE    P1,K4,MAINA          SEND HI PRI REQS TO NEXT BLOCK,
*                                      ALL OTHERS TO MAINA
       ASSIGN     3,K13                ASSIGN PROGRESS PARAMETER
       DEPART     QMAIN,3              REMOVE FROM QMAIN
       TRANSFER   ,DUTSC               SEND HI PRI REQS TO DUTSC
 MAINA ADVANCE    1                    DUMMY
       TRANSFER   ,MAINL               SEND ALL TO MAINL
 MAINE ENTER      MAIN
       DEPART     QMAIN,3
 MAIN  ADVANCE    V$MAINS              PICK AND STAGE MATERIAL
       LEAVE      MAIN
       TEST E     BV$WORKH,K1,TMAIN    DURING WORKING HOURS SEND ALL TO
*                                      NEXT BLOCK, ELSE TO TMAIN
       UNLINK     MAINC,MAINE,1,BACK   RELEASE ONE TRANSACTION FROM MAINC
*
 TMAIN TEST NE    P8,K1,DEEXQ          SEND WAREHOUSE REFUSALS TO
*                                      EXCEPTION HANDLING
*
       TEST E     BV$BEAR,K0,TERM      SEND BEARER ISSUES TO TERM, ALL
*                                      OTHERS TO NEXT BLOCK
*
       ASSIGN     4,FN$FEIGH           ASSIGN ISSUE DESTINATION
       ASSIGN     5,V$MAINW            ASSIGN ISSUE WEIGHT
*
       TEST G     V$TIME,1410,MQUE     IF LAST TRACTOR TRAIN OF DAY HAS
*                                      DEPARTED, SEND TO NEXT BLOCK, ELSE
*                                      MQUE
       TEST GE    P1,K4,MQUE           SEND HI PRI REQS TO NEXT BLOCK,
*                                      ALL OTHERS TO MQUE
*
       ASSIGN     3,K19                ASSIGN PROGRESS PARAMETER
*
       TRANSFER   ,DUTSC               TRANSFER ALL TO DUTSC
*
 MQUE  QUEUE      QATRN,3
 MLINK LINK       MCH,1PH              PLACE TRANSACTIONS ON A USER CHAIN
*                                      AWAITING ON-BASE TRANSPORTATION
```

```
**F WAREHOUSE AREA (F-8 - F-14)******************************************
 FWHEQ QUEUE      QFWHE,3
       TEST E     BV$LUNCH,K0,FWHEL    SEND ALL TO FWHEL DURING LUNCH,
*                                      ELSE NEXT BLOCK
       TEST E     BV$WORKH,K1,FWHET    SEND ALL TO NEXT BLOCK DURING
*                                      WORKING HOURS, ELSE SEND TO FWHET
       TEST E     R$FWHE,K0,FWHEE      SEND ALL TO FWHEE IF STORAGE IS
*                                      NOT FULL, ELSE NEXT BLOCK
 FWHEL LINK       FWHEC,1PH            LINK TO USER CHAIN FWHEC
 FWHET TEST GE    P1,K4,FWHEA          SEND HI PRI REQS TO NEXT BLOCK,
*                                      ALL OTHERS TO FWHEA
       ASSIGN     3,K14                ASSIGN PROGRESS PARAMETER
       DEPART     QFWHE,3              REMOVE FROM QFWHE
       TRANSFER   ,DUTSC               SEND HI PRI REQS TO DUTSC
 FWHEA ADVANCE    1                    DUMMY
       TRANSFER   ,FWHEL               SEND ALL TO FWHEL
 FWHEE ENTER      FWHE
       DEPART     QFWHE,3
 FWHE  ADVANCE    V$FWHES              PICK AND STAGE MATERIAL
       LEAVE      FWHE
       TEST E     BV$WORKH,K1,FWHT     DURING WORKING HOURS SEND ALL TO
*                                      NEXT BLOCK, ELSE TO FWHT
       UNLINK     FWHEC,FWHEE,1,BACK   RELEASE ONE TRANSACTION FROM FWHEC
*
 FWHT  TEST NE    P8,K1,DEEXQ          SEND WAREHOUSE REFUSALS TO
*                                      EXCEPTION HANDLING
*
       TEST E     BV$BEAR,K0,TERM      SEND BEARER ISSUES TO TERM, ALL
*                                      OTHERS TO NEXT BLOCK
*
       ASSIGN     4,FN$FNINE           ASSIGN ISSUE DESTINATION
*
       ASSIGN     5,V$FWHEW            ASSIGN ISSUE WEIGHT
*
       TEST G     V$TIME,1410,FQUE     IF LAST TRACTOR TRAIN OF DAY HAS
*                                      DEPARTED, SEND TO NEXT BLOCK, ELSE
*                                      FQUE
       TEST GE    P1,K4,FQUE           SEND HI PRI REQS TO NEXT BLOCK,
*                                      ALL OTHERS TO FQUE
*
       ASSIGN     3,K20                ASSIGN PROGRESS PARAMETER
*
       TRANSFER   ,DUTSC               TRANSFER ALL TO DUTSC
*
 FQUE  QUEUE      QATRN,3
 FLINK LINK       FCH,1PH              PLACE TRANSACTIONS ON A USER CHAIN
*                                      AWAITING ON-BASE TRANSPORTATION
```

```
**J WAREHOUSE AREA (J-11,J-12 AND GAS, LUMBER AND DRUM YARDS)************
 JWHEQ QUEUE      QJWHE,3
       TEST E     BV$LUNCH,K0,JWHEL     SEND ALL TO JWHEL DURING LUNCH,
*                                       ELSE NEXT BLOCK
       TEST E     BV$WORKH,K1,JWHET     SEND ALL TO NEXT BLOCK DURING
*                                       WORKING HOURS, ELSE SEND TO JWHET
       TEST E     R$JWHE,K0,JWHEE       SEND ALL TO JWHEE IF STORAGE IS
*                                       NOT FULL, ELSE NEXT BLOCK
 JWHEL LINK       JWHEC,1PH             LINK TO USER CHAIN JWHEC
 JWHET TEST GE    P1,K4,JWHEA           SEND HI PRI REQS TO NEXT BLOCK,
*                                       ALL OTHERS TO JWHEA
       ASSIGN     3,K15                 ASSIGN PROGRESS PARAMETER
       DEPART     QJWHE,3               REMOVE FROM QJWHE
       TRANSFER   ,DUTSC                SEND HI PRI REQS TO DUTSC
 JWHEA ADVANCE    1                     DUMMY
       TRANSFER   ,JWHEL                SEND ALL TO JWHEL
 JWHEE ENTER      JWHE
       DEPART     QJWHE,3
 JWHE  ADVANCE    V$JWHES               PICK AND STAGE MATERIAL
       LEAVE      JWHE
       TEST E     BV$WORKH,K1,JWHT      DURING WORKING HOURS SEND ALL TO
*                                       NEXT BLOCK, ELSE TO JWHT
       UNLINK     JWHEC,JWHEE,1,BACK    RELEASE ONE TRANSACTION FROM JWHEC
*
 JWHT  TEST NE    P8,K1,DEEXQ           SEND WAREHOUSE REFUSALS TO
*                                       EXCEPTION HANDLING
*
       TEST E     BV$BEAR,K0,TERM       SEND BEARER ISSUES TO TERM, ALL
*                                       OTHERS TO NEXT BLOCK
*
       ASSIGN     4,FN$FTEN             ASSIGN ISSUE DESTINATION
*
       ASSIGN     5,V$JWHEW             ASSIGN ISSUE WEIGHT
*
       TEST G     V$TIME,1410,JQUE      IF LAST TRACTOR TRAIN OF DAY HAS
*                                       DEPARTED, SEND TO NEXT BLOCK, ELSE
*                                       JQUE
       TEST GE    P1,K4,JQUE            SEND HI PRI REQS TO NEXT BLOCK,
*                                       ALL OTHERS TO JQUE
*
       ASSIGN     3,K21                 ASSIGN PROGRESS PARAMETER
*
       TRANSFER   ,DUTSC                TRANSFER ALL TO DUTSC
*
*
 JQUE  QUEUE      QBTRN,3
 JLINK LINK       JCH,1PH               PLACE TRANSACTIONS ON A USER CHAIN
*                                       AWAITING ON-BASE TRANSPORTATION
```

```
**********************************************************************
**           PROVISIONS TRACTOR TRAIN DELIVERY                      **
** IN ACTUAL NSD YOKOSUKA OPERATIONS, SPECIAL TRACTOR TRAIN RUNS    **
** ARE SCHEDULED TO MEET OPERATIONAL REQUIREMENTS OF THE            **
** REQUISITIONER. THESE SPECIAL RUNS ARE TYPICALLY SCHEDULED AFTER  **
** NORMALLY SCHEDULED RUNS ARE COMPLETED. THOUGH THE SCHEDULE IS NOT**
** FIXED, IN THE INTEREST OF MAINTAINING ACCURATE THROUGHPUT STATS, **
** A PROVISIONS TRACTOR TRAIN IS SCHEDULED FOR 1600 EACH DAY, WITH  **
** A SECOND RUN AT USER DISCRETION. ALL HIGH PRIORITY ISSUES THAT   **
** ARRIVE AFTER 1530 ARE ROUTED TO THE DUTY SECTION MODULE. THE     **
** PROVISIONS TRACTOR TRAIN SCHEDULE CONTROL SECTION IS PARTIONED   **
** AT THE TOP OF THE MODULE.                                        **
**********************************************************************
*
**SCHEDULE CONTROL SECTION********************************************
       GENERATE   2400,,1600           GENERATE CONTROL TRANSACTION
*                                      REPRESENTING DAILY TRACTOR
*                                      TRAIN FOR PROVISIONS AT 1600
       TEST NE    BV$WKDAY,K1,SPLTP    SEND TRAIN TO SPLTP IF WORKDAY,
*                                      ELSE NEXT BLOCK
       TERMINATE                       TERMINATE CONTROL TRANSACTION
 SPLTP SPLIT      1,LOADP              SPLIT CONTROL TRANSACTION, SEND
*                                      ONE COPY TO NEXT BLOCK AND ONE TO
*                                      LOADP
       ADVANCE    10                   DUMMY ADVANCE TO SEPARATE TRAINS
       TEST L     V$PWGHT,V$PXTRA,LOADP
*                                      IF THE ESTIMATED WEIGHT OF
*                                      ISSUES WAITING FOR THE PTRN
*                                      EXCEEDS PXTRA, SEND TO LOADP,
*                                      ELSE NEXT BLOCK
       TERMINATE                       TERMINATE CONTROL TRANSACTION
*
 LOADP UNLINK     PTRNC,PTRNT,ALL,BACK UNLINK ALL TRANSACTIONS FROM PTRNC
*                                      TO PTRNT
       SAVEVALUE  PNUM+,1,XF           COUNT PTRN RUNS
       TERMINATE                       TERMINATE CONTROL TRANSACTION
**OPERATIONS SECTION**************************************************
*
 PTRNQ TEST G     V$TIME,1610,PQUE     IF LAST TRACTOR TRAIN OF DAY HAS
*                                      DEPARTED, SEND TO NEXT BLOCK, ELSE
*                                      PQUE
       TEST GE    P1,K4,PQUE           SEND HI PRI REQS TO NEXT BLOCK,
*                                      ALL OTHERS TO PQUE
*
       ASSIGN     3,K16                ASSIGN PROGRESS PARAMETER
*
       TRANSFER   ,DUTSC               TRANSFER ALL TO DUTSC
*
 PQUE  QUEUE      QPTRN,3
 PLINK LINK       PTRNC,1PH            PLACE TRANSACTIONS ON A USER CHAIN
*                                      AWAITING ON-BASE TRANSPORTATION
 PTRNT TEST L     R$PTRN,P5,PTRNE      IF THERE IS SUFFICIENT REMAINING
*                                      CAPACITY IN PTRN SEND TO PTRNE,
*                                      ELSE NEXT BLOCK
       TEST LE    P1,K3,PTRNE          SEND HI PRI ISSUES TO PTRNE, ALL
*                                      OTHERS TO NEXT BLOCK
       ADVANCE    1                    DUMMY ADVANCE
       TRANSFER   ,PLINK               TRANSFER ALL BACK TO PLINK
 PTRNE ENTER      PTRN,PH5
       DEPART     QPTRN,3
       ADVANCE    8                    TRANSPORTATION DELAY TO J-39
       LEAVE      PTRN,PH5
       TRANSFER   ,FRTTE               TRANSFER ALL TO FRTTE
```

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**********************************************************************
**                TRACTOR TRAIN DELIVERY                            **
** CONTROL TRANSACTIONS REPRESENTING NSD-OPERATED TRACTOR TRAINS    **
** ARE GENERATED AT 0815,1015,1300,1400. ON WORKDAYS, THE           **
** TRANSACTIONS ARE ROUTED TO UNLINK MATERIAL TRANSACTIONS WAITING  **
** ON THE VARIOUS WAREHOUSE USER CHAINS. MATERIAL TRANSACTIONS ARE  **
** LINKED TO THE ATRNC OR BTRNC, AS APPROPRIATE, TO THE CAPACITY OF **
** THE RESPECTIVE TRAINS REMAINING AT EACH STOP. TRANSACTIONS ARE   **
** THEN UNLINKED AND MATERIAL REQUISITIONED BY SRF OR PWC IS SENT TO**
** TERMINATION TO SIMULATE DELIVERY. ALL OTHER ISSUES ARE UNLINKED  **
** TO THE FREIGHT TERMINAL MODULE. HIGH PRIORITY TRANSACTIONS THAT  **
** MISS THE LAST SCHEDULED TRAIN ARE SENT TO THE DUTY SECTION       **
** MODULE. AT USER DISCRETION, AN ADDITIONAL TRAIN MAY BE RUN ON    **
** EACH ROUTE AT 1500 TO REDUCE BACKLOG. THE TRACTOR TRAIN SCHEDULE **
** CONTROL SECTION IS PARTIONED AT THE TOP OF THE MODULE.           **
**********************************************************************
*
**SCHEDULE CONTROL SECTION********************************************
*
       GENERATE   2400,,825              GENERATE CONTROL TRANSACTION
*                                        REPRESENTING 0815 TRAINS
       TRANSFER   ,TRAIN                 SEND TO WAREHOUSES ON ROUTE
*
       GENERATE   2400,,1025             GENERATE CONTROL TRANSACTION
*                                        REPRESENTING 1015 TRAINS
       TRANSFER   ,TRAIN                 SEND TO WAREHOUSES ON ROUTE
*
       GENERATE   2400,,1300             GENERATE CONTROL TRANSACTION
*                                        REPRESENTING 1300 TRAINS
       TRANSFER   ,TRAIN                 SEND TO WAREHOUSES ON ROUTE
*
       GENERATE   2400,,1400             GENERATE CONTROL TRANSACTION
*                                        REPRESENTING 1400 TRAINS
       TRANSFER   ,TRAIN                 SEND TO WAREHOUSES ON ROUTE
*
       GENERATE   2400,,1500             GENERATE CONTROL TRANSACTION
*                                        REPRESENTING 1500 TRAINS
       TEST E     BV$WKDAY,K1,TTTRM      ON WORKDAYS, SEND TO NEXT BLOCK
       SPLIT      1,LATEB                SPLIT CONTROL TRANSACTION
       TEST L     V$AWGHT,V$AXTRA,LOADA
*                                        IF THE ESTIMATED WEIGHT OF
*                                        ISSUES WAITING FOR THE ATRN
*                                        EXCEEDS AXTRA, SEND TO LOADA,
*                                        ELSE NEXT BLOCK
       TERMINATE                         TERMINATE CONTROL TRANSACTION
*
 LATEB TEST L     V$BWGHT,V$BXTRA,LOADB
*                                        IF THE ESTIMATED WEIGHT OF
*                                        ISSUES WAITING FOR THE BTRN
*                                        EXCEEDS BXTRA, SEND TO LOADB,
*                                        ELSE NEXT BLOCK
       TERMINATE                         TERMINATE CONTROL TRANSACTION
*
 TRAIN TEST NE    BV$WKDAY,K1,LOAD       SEND TRAIN TO LOAD IF WORKDAY
 TTTRM TERMINATE                         TERMINATE CONTROL TRANSACTION
*
 LOAD  SPLIT      1,LOADB                SPLIT CONTROL TRANSACTION, SEND
*                                        ONE COPY TO NEXT BLOCK AND ONE TO
*                                        LOADB
```

```
**LOADING SECTION ***************************************************
*
 LOADA UNLINK     MCH,ATEST,ALL,BACK   UNLINK ALL TRANSACTIONS FROM MCH
*                                      TO ATRNT
       UNLINK     FCH,ATEST,ALL,BACK   UNLINK ALL TRANSACTIONS FROM FCH
*                                      TO ATRNT
       ADVANCE    17                   SIMULATE TRANSPORTATION TIME TO
*                                      F WAREHOUSE AREA
       UNLINK     MCH,ATRNT,ALL,BACK   UNLINK ALL TRANSACTIONS FROM MCH
*                                      TO ATRNT
       UNLINK     FCH,ATRNT,ALL,BACK   UNLINK ALL TRANSACTIONS FROM FCH
*                                      TO ATRNT
       ADVANCE    32                   SIMULATE TRANSPORTATION TIME TO
*                                      PWC/SRF
       UNLINK     ATRNC,ATRNL,ALL,BACK UNLINK ALL TRANSACTIONS FROM ATRNC
*                                      TO ATRNL
       SAVEVALUE  ANUM+,1,XF           COUNT ATRN RUNS
       TERMINATE                       TERMINATE CONTROL TRANSACTION
*
 LOADB UNLINK     JCH,BTEST,ALL,BACK   UNLINK ALL TRANSACTIONS FROM JCH
*                                      TO BTEST
       UNLINK     BCH,BTEST,ALL,BACK   UNLINK ALL TRANSACTIONS FROM BCH
*                                      TO BTEST
       UNLINK     ACH,BTEST,ALL,BACK   UNLINK ALL TRANSACTIONS FROM ACH
*                                      TO BTEST
       ADVANCE    8                    SIMULATE TRANSPORTATION TIME TO
*                                      J WAREHOUSE AREA
       UNLINK     JCH,BTRNT,ALL,BACK   UNLINK ALL TRANSACTIONS FROM JCH
*                                      TO BTRNT
       ADVANCE    3                    SIMULATE TRANSPORTATION TIME TO
*                                      B WAREHOUSE AREA
       UNLINK     BCH,BTRNT,ALL,BACK   UNLINK ALL TRANSACTIONS FROM BCH
*                                      TO BTRNT
       ADVANCE    10                   SIMULATE TRANSPORTATION TIME TO
*                                      A WAREHOUSE AREA
       UNLINK     ACH,BTRNT,ALL,BACK   UNLINK ALL TRANSACTIONS FROM ACH
*                                      TO BTRNT
       ADVANCE    17                   SIMULATE TRANSPORTATION TIME TO
*                                      PWC/SRF
       UNLINK     BTRNC,BTRNL,ALL,BACK UNLINK ALL TRANSACTIONS FROM BTRNC
*                                      TO BTRNL
       SAVEVALUE  BNUM+,1,XF           COUNT BTRN RUNS
       TERMINATE                       TERMINATE CONTROL TRANSACTION
```

```
**OPERATIONS SECTION - A TRAIN ROUTE**********************************
*
 ATEST TEST G     P1,K1,ASEND           SEND IPG3 ISSUES TO ASEND, ALL
*                                       OTHERS TO NEXT BLOCK
 ATRNT TEST L     R$ATRN,P5,ATRNE       IF THERE IS SUFFICIENT REMAINING
*                                       CAPACITY IN ATRN SEND TO ATRNE,
*                                       ELSE NEXT BLOCK
 ASEND ADVANCE    1                     DUMMY ADVANCE
       TRANSFER   FN,FTHFR              TRANSFER ALL BACK TO WAREHOUSE
 ATRNE ENTER      ATRN,PH5
       DEPART     QATRN,3
       LINK       ATRNC,1PH             LINK TO ATRNC
 ATRNL LEAVE      ATRN,PH5
       TRANSFER   ,TMTST                TRANSFER ALL TO TMTST
*
**OPERATIONS SECTION - B TRAIN ROUTE**********************************
*
 BTEST TEST G     P1,K1,BSEND           SEND IPG3 ISSUES TO BSEND, ALL
*                                       OTHERS TO NEXT BLOCK
 BTRNT TEST L     R$BTRN,P5,BTRNE       IF THERE IS SUFFICIENT REMAINING
*                                       CAPACITY IN BTRN SEND TO BTRNE,
*                                       ELSE NEXT BLOCK
 BSEND ADVANCE    1                     DUMMY ADVANCE
       TRANSFER   FN,FTHFV              TRANSFER ALL BACK TO WAREHOUSE
 BTRNE ENTER      BTRN,PH5
       DEPART     QBTRN,3
       LINK       BTRNC,1PH             LINK TO BTRNC
 BTRNL LEAVE      BTRN,PH5
*
**TEST FOR PWC/PRF DELIVERY*******************************************
*
 TMTST TEST NE    P4,K1,TERM            SEND ISSUES FOR SRF AND PWC TO
*                                       TERM TO SIMULATE DELIVERY BY
*                                       TRACTOR TRAIN, ALL OTHERS TO NEXT
       ADVANCE    17                    SIMULATE TRANSPORTATION TIME TO
*                                       FREIGHT TERMINAL
```

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**********************************************************************
**                  FREIGHT TERMINAL MODULE                         **
** TRANSACTIONS REPRESENTING MATERIAL ARE TESTED FOR PACK TYPE      **
** REQUIRED AND SENT TO LIGHT OR HEAVY PACK LINES AS APPROPRIATE    **
** (PARCEL POST PACKS GO TO THE LIGHT PACK LINE). PACK TIMES        **
** IN THE LIGHT PACK LINE ARE OBTAINED FROM FUNCTION FTWSV. AFTER   **
** PACKING IS COMPLETED, ALL ISSUES ARE ROUTED TO THE TERMINATION   **
** MODULE AS AVAILABLE FOR SHIPMENT. MATERIAL RECEIVED FROM TRACTOR **
** TRAINS THAT DOES NOT REQUIRE PACKING IS SENT DIRECTLY TO THE     **
** TERMINATION MODULE AS AVAILABLE FOR SHIPMENT.                    **
**********************************************************************
*
**********************************************************************
*
 FRTTE TEST E     P4,K2,TERM           SEND ISSUES AVAILABLE FOR SHIPMENT
*                                      SHIPMENT TO TERM, ALL OTHERS TO
*                                      NEXT BLOCK
*
       TRANSFER   .V$LITEP,,LITPQ      TRANSFER ISSUES REQUIRING LIGHT OR
*                                      PARCEL POST PACK TO LITEQ, ALL
*                                      OTHERS TO NEXT BLOCK
*
**HEAVY PACK OPERATIONS SECTION***************************************
*
 HVYPQ QUEUE      QHVYP,3
       TEST E     BV$LUNCH,K0,HVYPL    SEND ALL TO HVYPL DURING LUNCH,
*                                      ELSE NEXT BLOCK
       TEST E     BV$WORKH,K1,HVYPT    SEND ALL TO NEXT BLOCK DURING
*                                      WORKING HOURS, ELSE SEND TO HVYPT
       TEST E     R$HVYP,K0,HVYPE      SEND ALL TO HVYPE IF STORAGE IS
*                                      NOT FULL, ELSE NEXT BLOCK
 HVYPL LINK       HVYPC,1PH            LINK TO USER CHAIN HVYPC
 HVYPT TEST GE    P1,K4,HVYPA          SEND HI PRI REQS TO NEXT BLOCK,
*                                      ALL OTHERS TO HVYPA
       ASSIGN     3,K22                ASSIGN PROGRESS PARAMETER
       DEPART     QHVYP,3              REMOVE FROM QHVYP
       TRANSFER   ,DUTSC               SEND HI PRI REQS TO DUTSC
 HVYPA ADVANCE    1                    DUMMY
       TRANSFER   ,HVYPL               SEND ALL TO HVYPL
 HVYPE ENTER      HVYP
       DEPART     QHVYP,3
 HVYP  ADVANCE    V$HVYPS              PACK MATERIAL REQUIRING HEAVY PACK
       LEAVE      HVYP
       TEST E     BV$WORKH,K1,HVYTR    DURING WORKING HOURS SEND ALL TO
*                                      NEXT BLOCK, ELSE TO HVYTR
       UNLINK     HVYPC,HVYPE,1,BACK   RELEASE ONE TRANSACTION FROM HVYPC
 HVYTR TRANSFER   ,TERM
```

```
**LIGHT AND PARCEL POST PACK OPERATIONS SECTION***********************
*
 LITPQ QUEUE       QLITP,3
       TEST E      BV$LUNCH,K0,LITPL     SEND ALL TO LITPL DURING LUNCH,
*                                        ELSE NEXT BLOCK
       TEST E      BV$WORKH,K1,LITPT     SEND ALL TO NEXT BLOCK DURING
*                                        WORKING HOURS, ELSE SEND TO LITPT
       TEST E      R$LITP,K0,LITPE       SEND ALL TO LITPE IF STORAGE IS
*                                        NOT FULL, ELSE NEXT BLOCK
 LITPL LINK        LITPC,1PH             LINK TO USER CHAIN LITPC
 LITPT TEST GE     P1,K4,LITPA           SEND HI PRI REQS TO NEXT BLOCK,
*                                        ALL OTHERS TO LITPA
       ASSIGN      3,K23                 ASSIGN PROGRESS PARAMETER
       DEPART      QLITP,3               REMOVE FROM QLITP
       TRANSFER    ,DUTSC                SEND HI PRI REQS TO DUTSC
 LITPA ADVANCE     1                     DUMMY
       TRANSFER    ,LITPL                SEND ALL TO LITPL
 LITPE ENTER       LITP
       DEPART      QLITP,3
 LITP  ADVANCE     V$LITPS               PACK MATERIAL REQUIRING LIGHT OR
*                                        PARCEL POST PACK
       LEAVE       LITP
       TEST E      BV$WORKH,K1,LITTR     DURING WORKING HOURS SEND ALL TO
*                                        NEXT BLOCK, ELSE TO LITTR
       UNLINK      LITPC,LITPE,1,BACK    RELEASE ONE TRANSACTION FROM LITPC
 LITTR TRANSFER    ,TERM
```

```
**********************************************************************
**                      DUTY SECTION                                **
** THE SCHEDULE CONTROL SECTION GENERATES A CONTROL TRANSACTION AT  **
** AT THE START OF EACH DAY TO CONTROL DUTY SECTION OPERATIONS. ON  **
** WORKDAYS, ADVANCE BLOCKS MOVE THE TRANSACTION THRU THE SCHEDULE  **
** CONTROL SECTION. AT APPROPRIATE TIMES, THE STORAGE REPRESENTING  **
** THE DUTY SECTION IS OPENED AND CLOSED AND TRANSACTIONS ARE LINKED**
** TO AND UNLINKED FROM USER CHAINS WITHIN THE OPERATING SECTION.   **
**********************************************************************
** THE DUTY SECTION OPERATIONS SECTION SIMULATES NSD LATE SHIFT AND **
** DUTY SECTION OPERATIONS. THE DUTY STORAGE HAS A CAPACITY OF TWO  **
** MATCHING THE NUMBER OF PERSONNEL ACTUALLY AVAILABLE IN BOTH THE  **
** LATE SHIFT AND THE DUTY SECTION TO PROCESS ISSUES. TRANSACTIONS  **
** ENTERING THE MODULE ARE SPLIT INTO THREE TRANSACTIONS TO RESTORE **
** THE ACTUAL DEMAND LEVEL AND ADVANCED TO THE POINT OF PROGRESS    **
** INDICATED BY P3. TRANSACTIONS TRANSFERRED TO THE DUTY SECTION    **
** BUT NOT PROCESSED ARE TRANSFERRED BACK TO THEIR MODULE OF ORIGIN.**
** COMPLETED ISSUES ARE TERMINATED AS APPROPRIATE (NIS OR AVAILABLE **
** FOR SHIPMENT). NOTE: BECAUSE MOST HIGH PRIORITY PERISHABLE       **
** PROVISIONS ISSUES MADE OUTSIDE OF NORMAL WORKING HOURS BY NSD    **
** ARE FOR FLEET ACTIVITIES, YOKOHAMA COLD STORAGE REQUISITIONS ARE **
** ROUTED INSTEAD TO YOKOSUKA COLD STORAGE.                         **
**********************************************************************
*
**SCHEDULE CONTROL SECTION********************************************
*
       GENERATE   2400,0,1              GENERATE CONTROL TRANSACTION
*
       TEST E     BV$WKDAY,K1,DTEND     SEND TO DTEND IF SAT/SUN ELSE NEXT
*                                       BLOCK
       ADVANCE    800                   ADVANCE TO 0801
       UNLINK     DUTYC,DUTYD,ALL,BACK  UNLINK TRANSACTIONS NOT PROCESSED
*                                       BY THE DUTY SECTION
       ADVANCE    875                   ADVANCE TO 1646
       UNLINK     DUTYC,DUTYS,2,BACK    UNLINK 2 TRANSACTIONS FOR DUTY
*                                       SECTION PROCESSING
 DTEND TERMINATE                        TERMINATE CONTROL TRANSACTION
```

```
**OPERATIONS SECTION**************************************************
*
 DUTSC QUEUE      DUTYQ
       TEST NE    BV$OPEN,K1,DUTYL     IF OUTSIDE WORKING HOURS, SEND
*                                      TO NEXT BLOCK, ELSE DUTYL
       TEST E     R$DUTY,K0,DUTYS      IF DUTY STORAGE IS NOT FULL, SEND
*                                      TO DUTYS, ELSE NEXT BLOCK
 DUTYL LINK       DUTYC,1PH            LINK TO USER CHAIN DUTYC
 DUTYD DEPART     DUTYQ
       TRANSFER   FN,FTHIR             TRANSFER ALL TRANSACTIONS NOT
*                                      PROCESSED BY THE DUTY SECTION BACK
*                                      TO THE POINT OF PROGRESS INDICATED
*                                      BY P3
 DUTYS SPLIT      2,QSPLT              SPLIT EACH TRANSACTION INTO THREE
       TRANSFER   ,DUTYE               TRANSFER ALL TO DUTYE
 QSPLT QUEUE      DUTYQ                ADD SPLIT TRANSACTIONS TO QUEUE
 DUTYE ENTER      DUTY
       DEPART     DUTYQ
       TRANSFER   FN,FTHON             TRANSFER ALL TRANSACTIONS TO BE
*                                      WORKED BY THE DUTY SECTION TO
*                                      THE POINT OF PROGRESS INDICATED BY
*                                      P3
*
 PZERO ADVANCE    FN$FELEV             STOCK CHECK ALL REQUISITIONS
       TRANSFER   .V$GROSS,,RTE        TRANSFER IN STOCK REQS TO RTE,
*                                      NIS REQS TO NEXT BLOCK
       ASSIGN     3,K2                 TAG NIS REQS
       LEAVE      DUTY
       TRANSFER   ,DUTTR
 PONE  TEST NE    P6,K2,RTE            SEND IN STOCK REQS TO RTE, ALL
*                                      OTHERS TO NEXT BLOCK
       ADVANCE    FN$FELEV             PERFORM STOCK CHECK
       TEST E     P6,K1,RTE            SEND NIS REQS TO NEXT BLOCK, ALL
*                                      OTHERS TO NEXT BLOCK
       ASSIGN     3,K2                 TAG NIS REQS
       LEAVE      DUTY
       TRANSFER   ,DUTTR
 RTE   ADVANCE    FN$FTWEL             REMOTE TERMINAL ENTRY OF REQS
       TRANSFER   .V$NOTEX,,WHEAS      SEND DEMAND EXCEPTIONS TO NEXT
*                                      BLOCK, ALL OTHERS TO WHEAS
 PTHRE ADVANCE    FN$FFRTN             PROCESS DEMAND EXCEPTIONS
 WHEAS ASSIGN     2,FN$FTWO            ASSIGN WAREHOUSE LOCATION
 WRTR  TRANSFER   .V$NOTWR,,PFOUR      SEND WAREHOUSE REFUSALS TO NEXT
*                                      BLOCK, ALL OTHERS TO PFOUR
       ASSIGN     8,K1                 TAG WAREHOUSE REFUSALS
 PFOUR TEST E     P2,K1,SORT           SEND YOKOHAMA ISSUE DOCS TO NEXT
*                                      BLOCK, ALL OTHERS TO SORT
       ASSIGN     2,K2                 REASSIGN YOKOHAMA REQS TO YOKOSUKA
*                                      COLD STORAGE
 SORT  ADVANCE    FN$FSXTN             MARK,BURST ISSUE DOCS
 PSIX  ADVANCE    FN$FTHSV             DRIVE TO WAREHOUSE LOCATION
 PEIGH ADVANCE    FN$FSVTN             MAKE PICK
       TEST E     P8,K1,TURN           SEND WAREHOUSE REFUSALS TO NEXT
*                                      BLOCK, ALL OTHERS TO TURN
       ASSIGN     3,K25                TAG WAREHOUSE REFUSALS
       LEAVE      DUTY
       TRANSFER   ,DUTTR
 TURN  TEST E     BV$BEAR,K1,DESTA     SEND BEARER ISSUES TO NEXT BLOCK,
*                                      ALL OTHERS TO DESTA
       ASSIGN     3,K24                TAG BWT ISSUES
       LEAVE      DUTY
       TRANSFER   ,DUTTR
 DESTA ASSIGN     4,FN$FTHRE           ASSIGN ISSUE DESTINATION TO P4
 PSXTN ADVANCE    FN$FTHEI             DRIVE TO FREIGHT TERMINAL
       TEST E     P4,K2,SHIP           SEND ISSUES REQUIRING PACKING TO
*                                      NEXT BLOCK, ALL OTHERS TO SHIP
       TRANSFER   .V$LITEP,,PTWTH      SEND ISSUES REQUIRING HEAVY PACK
*                                      TO NEXT BLOCK, ALL OTHERS TO PTWTH
 PTWTW ADVANCE    FN$FTWSX             HEAVY PACK
       TRANSFER   ,SHIP                SEND ALL TO SHIP
 PTWTH ADVANCE    FN$FTWSV               LIGHT/PARCEL POST PACK
 SHIP  ASSIGN     3,K24                  TAG AS AVAILABLE FOR SHIPMENT
       LEAVE      DUTY
 DUTTR ADVANCE                           DUMMY ADVANCE
       TEST E     BV$THREE,K1,SEND
       UNLINK     DUTYC,DUTYS,1,BACK
*                                        UNLINK ONE TRANSACTION FROM DUTYC
*                                        FOR EVERY THREE LEAVING
 SEND  TRANSFER   FN,FTHIR               SEND ISSUES TO LOCATION DETERMINED
*                                        BY PROGRESS PARAMETER
```

```
************************************************************************
**                    TERMINATION MODULE                              **
** IN THE TABLE DEFINITION SECTION, FREQUENCY DISTRIBUTION TABLES     **
** ARE DEFINED TO MEASURE THROUGHPUT TIME FOR ALL ISSUES (ALL) AND    **
** BY ISSUE PRIORITY GROUP (IPGON,IPGTW,IPGTH). TABULATION OF          **
** ISSUES IN APPROPRIATE TABLES IS MANAGED BY ROUTING TRANSACTIONS    **
** BY PARAMETER ONE VALUES. RAW COUNTS ARE MADE ON NIS AND            **
** WAREHOUSE REFUSAL TRANSACTIONS.                                    **
************************************************************************
*
**TABLE DEFINITIONS*****************************************************
*
 ALL   TABLE      M1,0,1200,22
 IPGON TABLE      M1,0,1200,16
 IPGTW TABLE      M1,0,1200,16
 IPGTH TABLE      M1,0,1200,22
*
**ISSUE COUNT, TABULATION AND TERMINATION*******************************
*
 TERM  SPLIT      2,ALLCT                    SPLIT EACH TRANSACTION INTO 3 TO
*                                            RESTORE DEMAND LEVEL
 ALLCT TABULATE   ALL                        ENTER ALL ISSUES INTO TABLE ALL
       TEST NE    P1,K1,TMTHR                SEND IPG3 TRANSACTIONS TO TMTHR,
*                                            ALL OTHERS TO NEXT BLOCK
       TEST G     P1,K5,TMTWO                SEND IPG2 TRANSACTIONS TO TMTWO,
*                                            ALL OTHERS TO NEXT BLOCK
 TMONE TABULATE   IPGON                      ENTER IPG1 TRANSACTIONS INTO
*                                            TABLE IPGON
       TERMINATE                             TERMINATE IPG1 TRANSACTIONS
 TMTWO TABULATE   IPGTW                      ENTER IPG2 TRANSACTIONS INTO
*                                            TABLE IPGTW
       TERMINATE                             TERMINATE IPG2 TRANSACTIONS
 TMTHR TABULATE   IPGTH                      ENTER IPG3 TRANSACTIONS INTO
*                                            TABLE IPGTH
       TERMINATE                             TERMINATE IPG3 TRANSACTIONS
*
 NISTM SPLIT      2,DTNIS
 DTNIS SAVEVALUE  NISCT+,1,XF                COUNT NIS REQS
       TERMINATE                             TERMINATE NIS REQS
*
 WRTRM SPLIT      2,DTWR
 DTWR  SAVEVALUE  WRCT+,1,XF                 COUNT WAREHOUSE REFUSALS
       TERMINATE                             TERMINATE WAREHOUSE REFUSALS
```

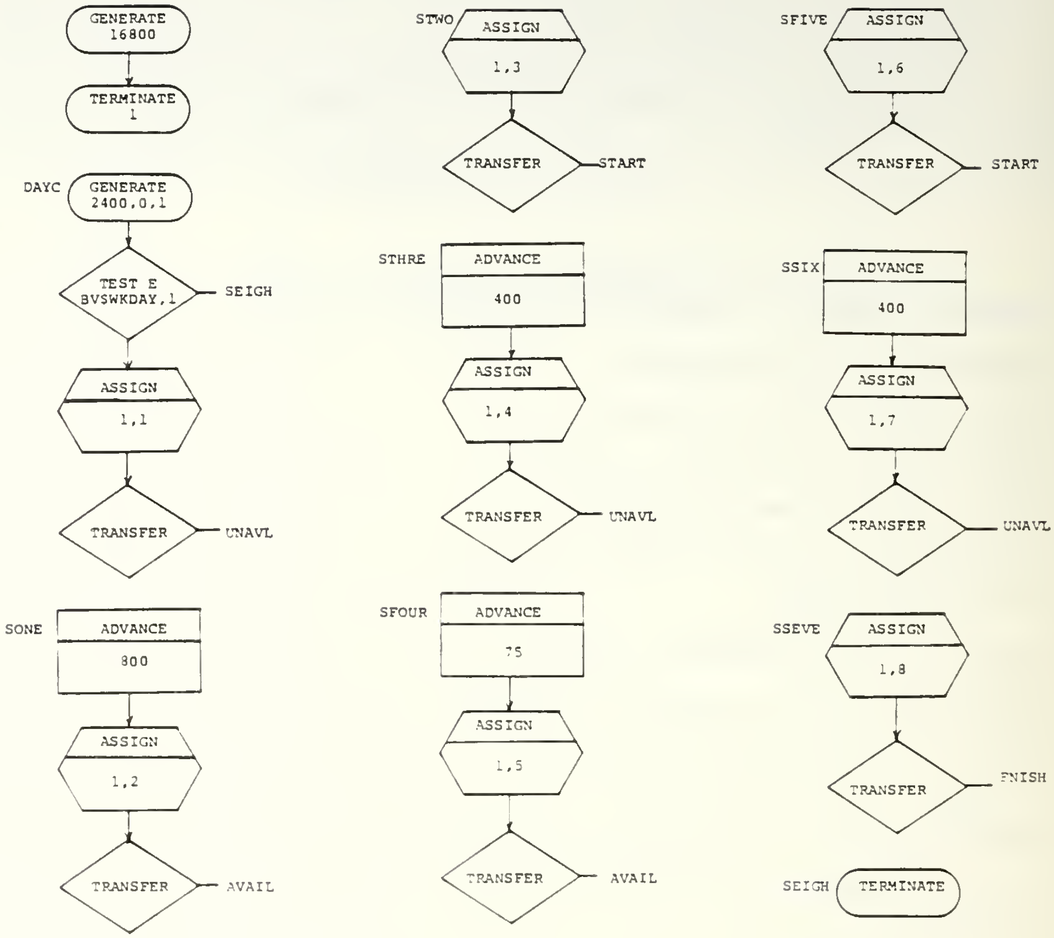
```
**********************************************************************
**                 SIMULATION RUN CONTROL                           **
** THE FIRST START STATEMENT AND THE FOLLOWING RESET STATEMENT ARE  **
** USED TO BRING THE MODEL TO STEADY STATE, THAT IS, TO FILL IT     **
** WITH TRANSACTIONS SO THAT THE SIMULATION DOES NOT START WITH AN  **
** EMPTY SUPPLY DEPOT. THE INITIAL STATEMENT RESETS ALL SAVEVALUES  **
** USED TO GATHER STATISTICS DURING THE SIMULATION TO ZERO. THE     **
** FINAL START STATEMENT REFERS TO FIRST TERMINATE STATEMENT IN THE **
** MASTER SCHEDULE CONTROL MODULE, TERMINATING THE SIMULATION WHEN  **
** THE 4TH TRANSACTIONS ENTERS THAT BLOCK.                          **
**********************************************************************
*
       START      2,NP
       RESET
       INITIAL    XF$REQCT,0/XF$PRION,0/XF$PRITW,0/XF$PRITH,0
       INITIAL    XF$ANUM,0/XF$BNUM,0/XF$PNUM,0
       INITIAL    XF$NISCT,0/XF$WRCT,0
       START      4,,1
       END
//
```

APPENDIX B

GPSS BLOCK DIAGRAM

TABLE OF CONTENTS

Master Schedule Control Module 100
Storage Control Module 101
User Chain Control Module. 102
Requisition Generation Module. 103
Requisition Receipt Module 104
NSD Remote Terminal Entry Module 105
CPU Tests Module 105
Printer Queue Handling Module. 106
Demand Exception Handling Module 107
Warehouse Assignment Module. 107
Storage Control/Storage Office Module. 108
Yokohama Issue Document Delivery Module. 109
Bicycle Messenger Delivery Module. 109
Warehouses Module. 110
Provisions Tractor Train Delivery Module 118
Tractor Train Delivery Module. 119
Freight Terminal Module. 121
Duty Section Module. 122
Termination Module 124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TERMINATE
1
DAYC
GENERATE
2400,0,1
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BV$WKDAY,1
SEIGH
ASSIGN
1,1
TRANSFER
UNAVL
SONE
ADVANCE
800
ASSIGN
1,2
TRANSFER
AVAIL
STWO
ASSIGN
1,3
TRANSFER
START
STHRE
ADVANCE
400
ASSIGN
1,4
TRANSFER
UNAVL
SFOUR
ADVANCE
75
ASSIGN
1,5
TRANSFER
AVAIL
SFIVE
ASSIGN
1,6
TRANSFER
START
SSIX
ADVANCE
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ASSIGN
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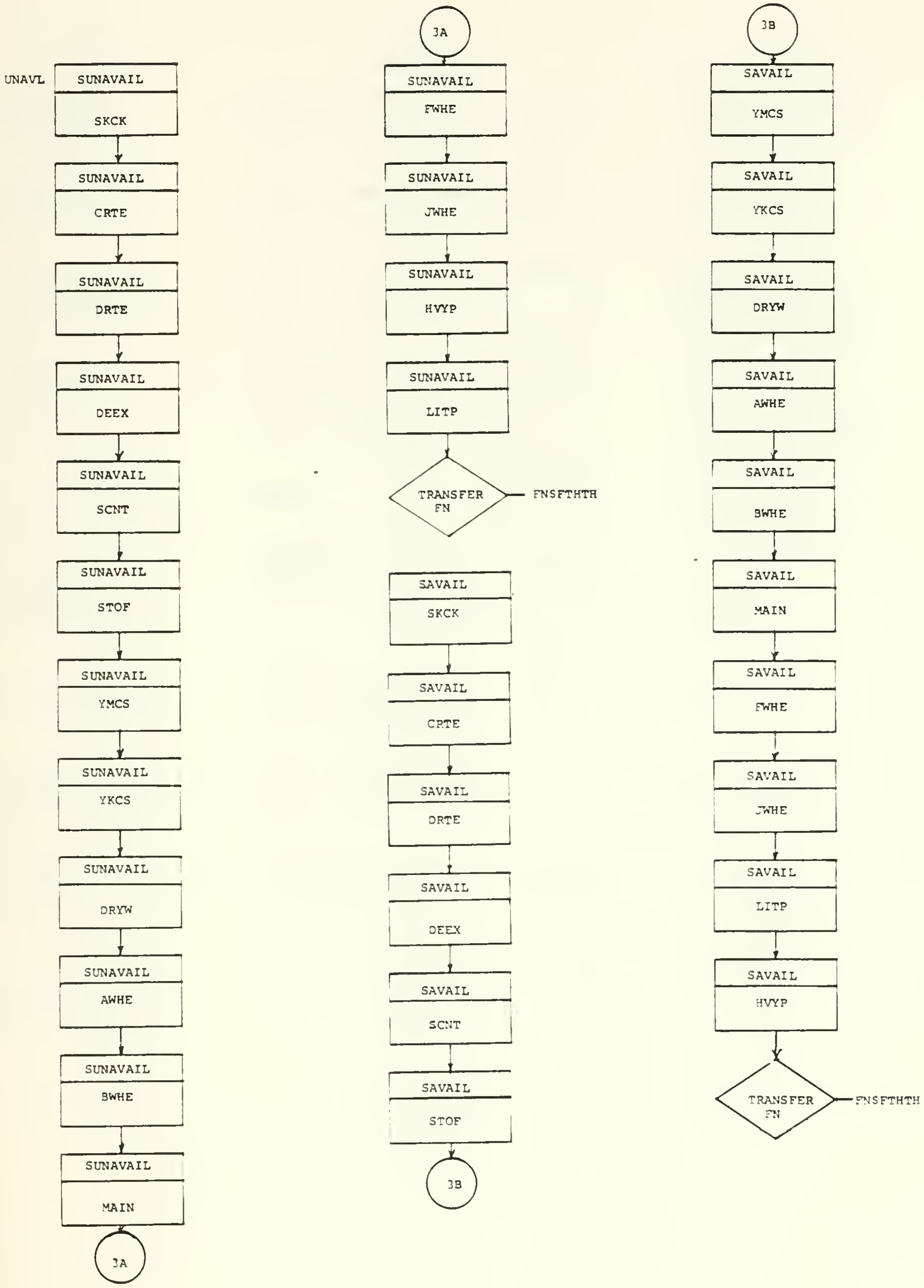
TRANSFER
FNISH
SEIGH
TERMINATE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SUNAVAIL
SKCK
SUNAVAIL
CRTE
SUNAVAIL
DRTE
SUNAVAIL
DEEX
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SCNT
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STOF
SUNAVAIL
YMCS
SUNAVAIL
YKCS
SUNAVAIL
DRYW
SUNAVAIL
AWHE
SUNAVAIL
BWHE
SUNAVAIL
MAIN
3A
3A
SUNAVAIL
FWHE
SUNAVAIL
JWHE
SUNAVAIL
HVYP
SUNAVAIL
LITP
TRANSFER FN
FNSFTHTH
SAVAIL
SKCK
SAVAIL
CRTE
SAVAIL
DRTE
SAVAIL
DEEX
SAVAIL
SCNT
SAVAIL
STOF
3B
3B
SAVAIL
YMCS
SAVAIL
YKCS
SAVAIL
DRYW
SAVAIL
AWHE
SAVAIL
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LITP
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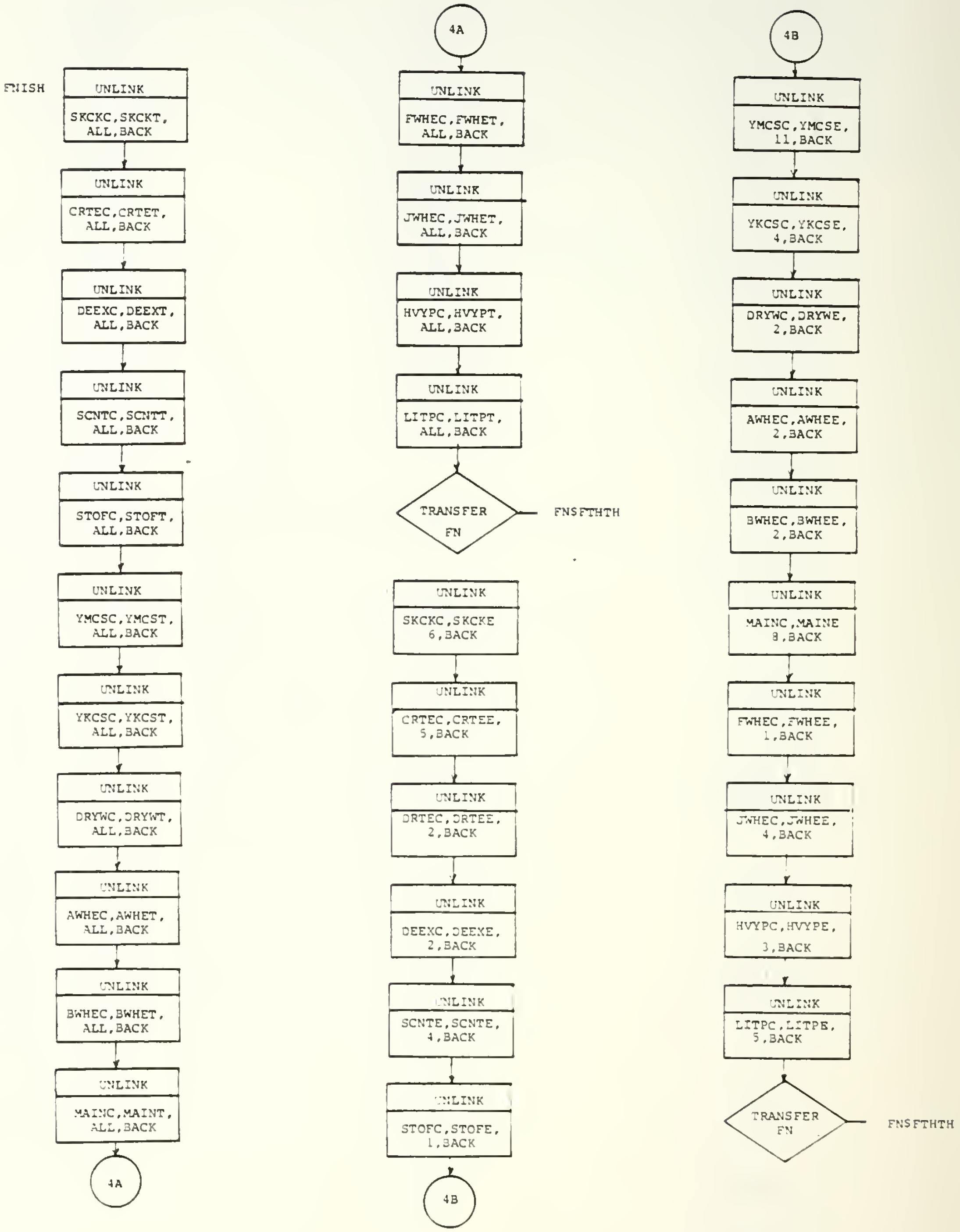
HVYP
TRANSFER FN
FNSFTHTH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ALL,BACK
UNLINK
DEEXC,DEEXT,
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SCNTC,SCNTT,
ALL,BACK
UNLINK
STOFC,STOFT,
ALL,BACK
UNLINK
YMCSC,YMCST,
ALL,BACK
UNLINK
YKCSC,YKCST,
ALL,BACK
UNLINK
DRYWC,DRYWT,
ALL,BACK
UNLINK
AWHEC,AWHET,
ALL,BACK
UNLINK
BWHEC,BWHET,
ALL,BACK
UNLINK
MAINC,MAINT,
ALL,BACK
4A
4A
UNLINK
FWHEC,FWHET,
ALL,BACK
UNLINK
JWHEC,JWHET,
ALL,BACK
UNLINK
HVYPC,HVYPT,
ALL,BACK
UNLINK
LITPC,LITPT,
ALL,BACK
TRANSFER
FN
FNSFTHTH
UNLINK
SKCKC,SKCKE
6,BACK
UNLINK
CRTEC,CRTEE,
5,BACK
UNLINK
DRTEC,DRTEE,
2,BACK
UNLINK
DEEXC,DEEXE,
2,BACK
UNLINK
SCNTE,SCNTE,
4,BACK
UNLINK
STOFC,STOFE,
1,BACK
4B
4B
UNLINK
YMCSC,YMCSE,
11,BACK
UNLINK
YKCSC,YKCSE,
4,BACK
UNLINK
DRYWC,DRYWE,
2,BACK
UNLINK
AWHEC,AWHEE,
2,BACK
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BWHEC,BWHEE,
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MAINC,MAINE
8,BACK
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FWHEC,FWHEE,
1,BACK
UNLINK
JWHEC,JWHEE,
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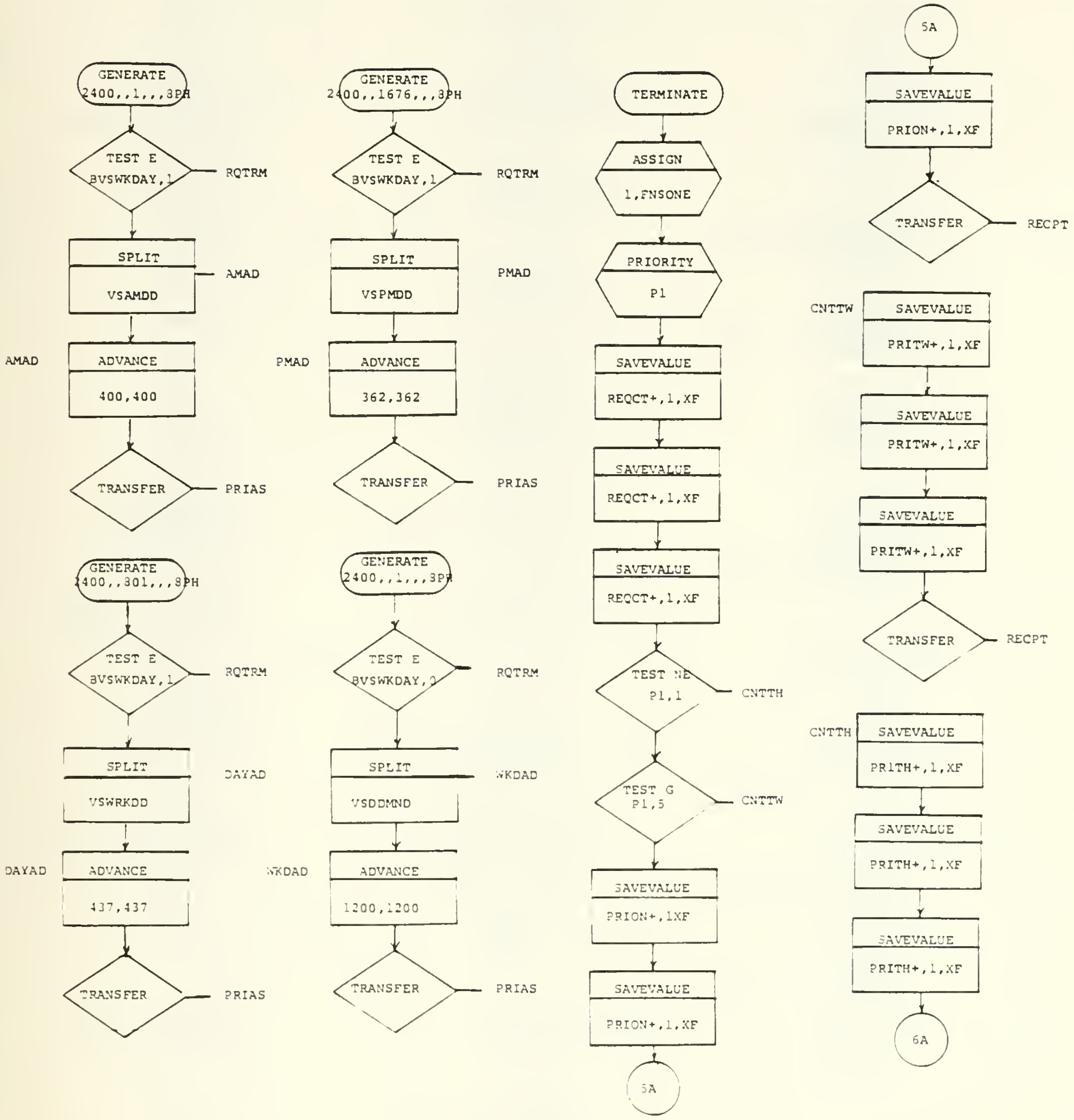
5,BACK
TRANSFER
FN
FNSFTHTH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AMAD
AMAD
ADVANCE
400,400
TRANSFER
PRIAS
GENERATE
2400,,801,,,8PH
TEST E
BVSWKDAY,1
RQTRM
SPLIT
VSWRKDD
DAYAD
DAYAD
ADVANCE
437,437
TRANSFER
PRIAS
GENERATE
2400,,1676,,,8PH
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RQTRM
SPLIT
VSPMDD
PMAD
PMAD
ADVANCE
362,362
TRANSFER
PRIAS
GENERATE
2400,,1,,,8PH
TEST E
BVSWKDAY,0
RQTRM
SPLIT
VSDDMND
WKDAD
WKDAD
ADVANCE
1200,1200
TRANSFER
PRIAS
TERMINATE
ASSIGN
1,FNSONE
PRIORITY
P1
SAVEVALUE
REQCT+,1,XF
SAVEVALUE
REQCT+,1,XF
SAVEVALUE
REQCT+,1,XF
TEST NE
P1,1
CNTTH
TEST G
P1,5
CNTTW
SAVEVALUE
PRION+,1XF
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PRION+,1,XF
5A
5A
SAVEVALUE
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TRANSFER
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CNTTW
SAVEVALUE
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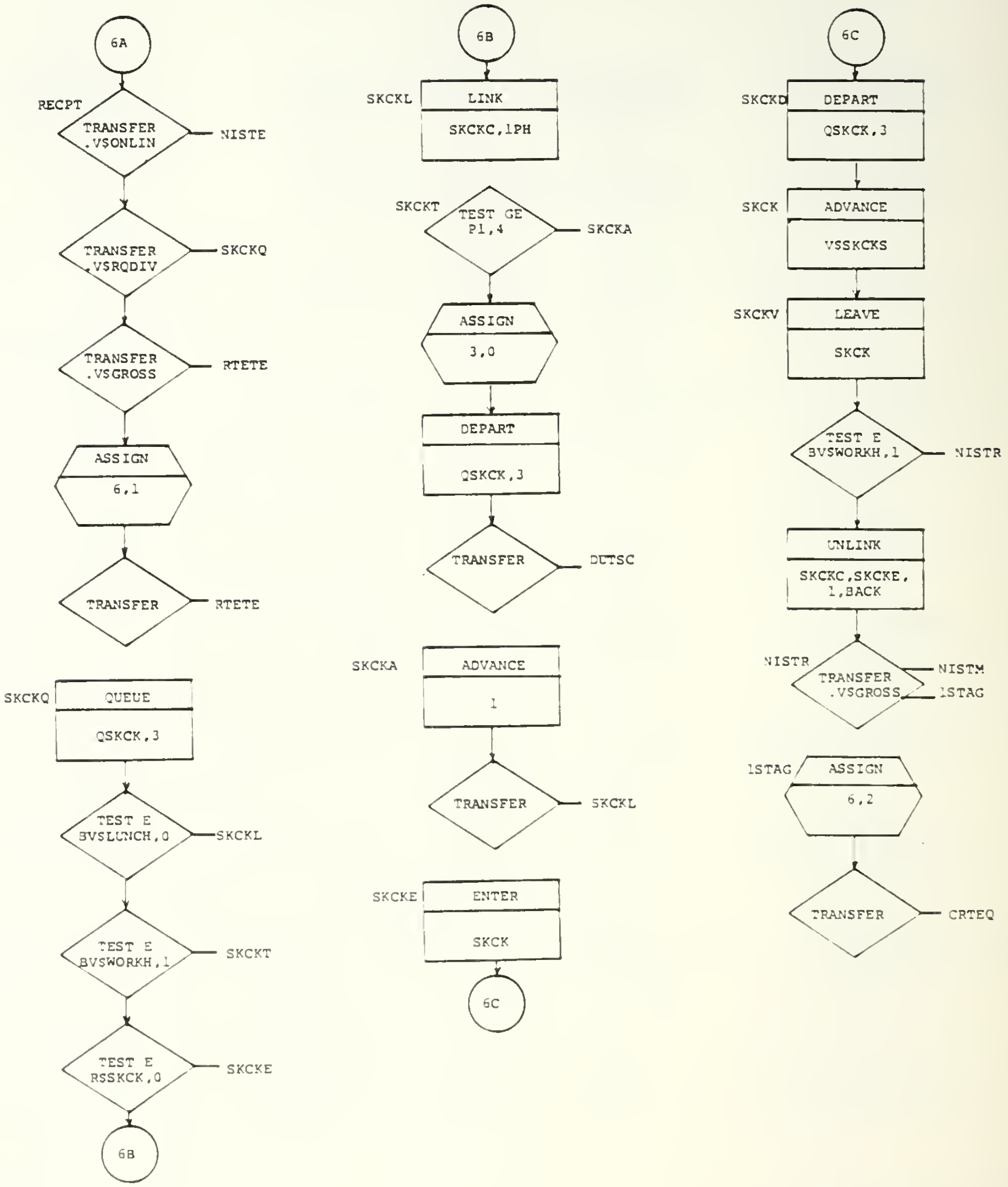
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SKCKL
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SKCKT
TEST E RSSKCK,0
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LINK
SKCKC,1PH
SKCKT
TEST GE P1,4
SKCKA
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DUTSC
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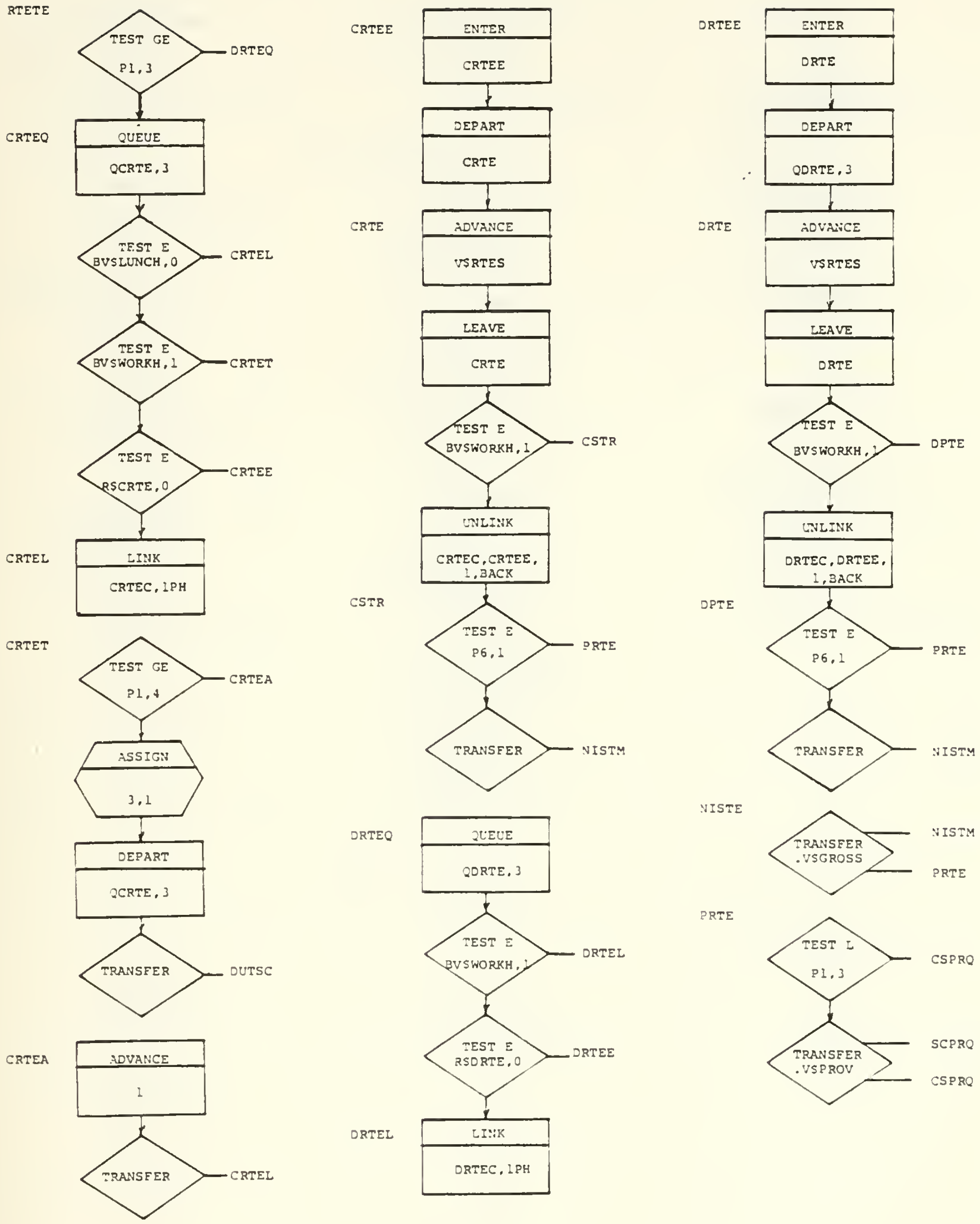
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ASSIGN
3,1
DEPART
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TRANSFER
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CRTEA
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ENTER
CRTEE
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LEAVE
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ADVANCE
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BVSWORKH,1
DPTE
UNLINK
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DPTE
TEST E
P6,1
PRTE
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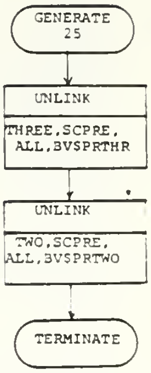
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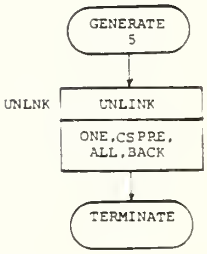
UNLINK
TWO,SCPRE,
ALL,BVSPRTWO
TERMINATE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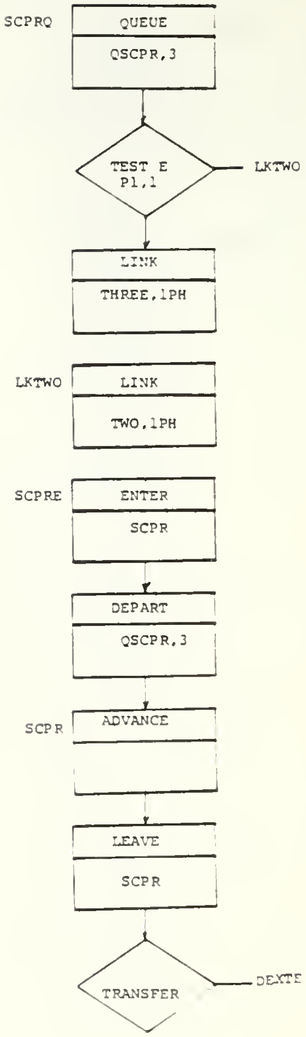
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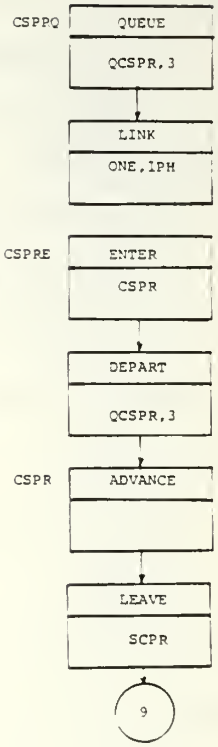
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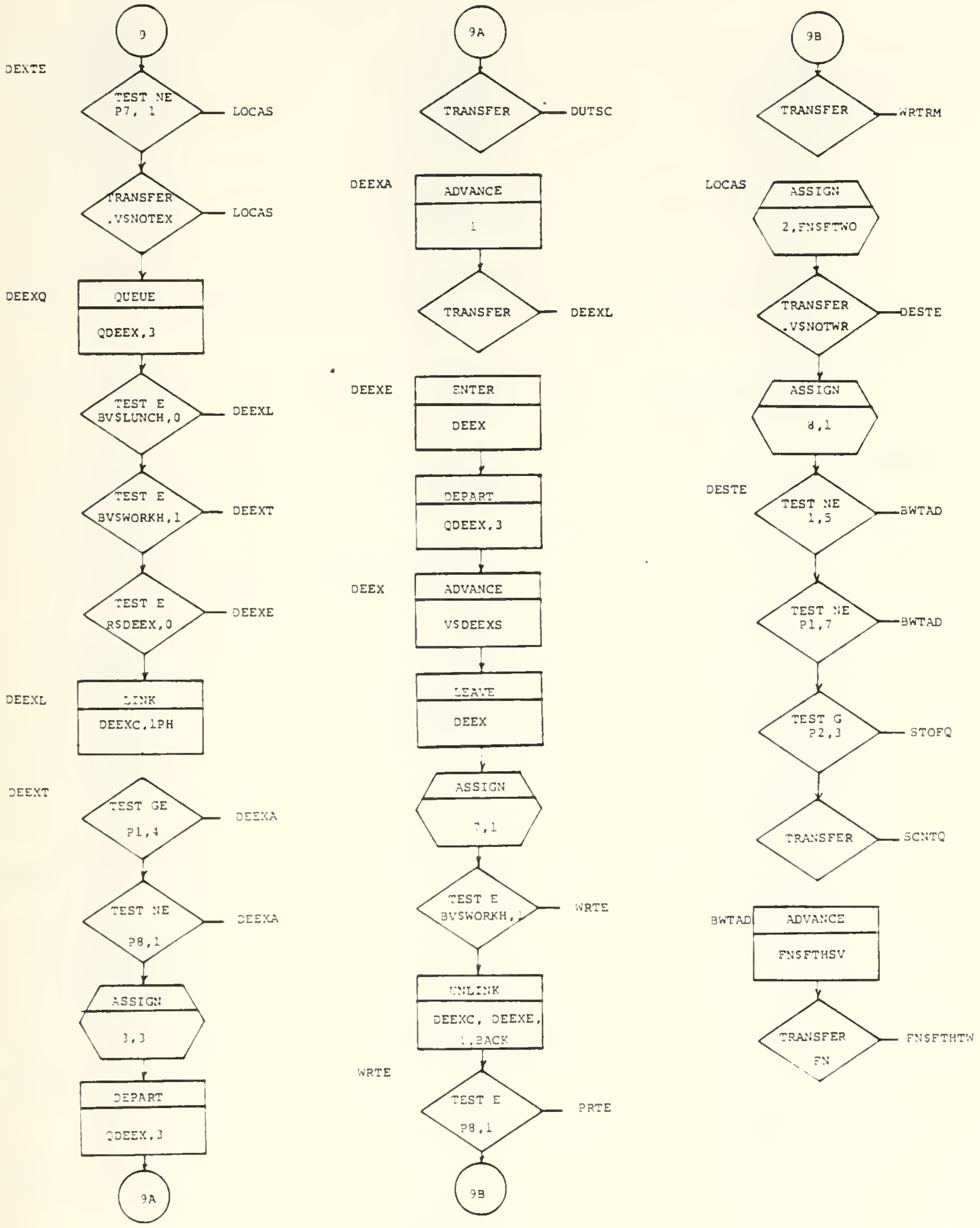
LEAVE
SCPR
9


9
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LOCAS
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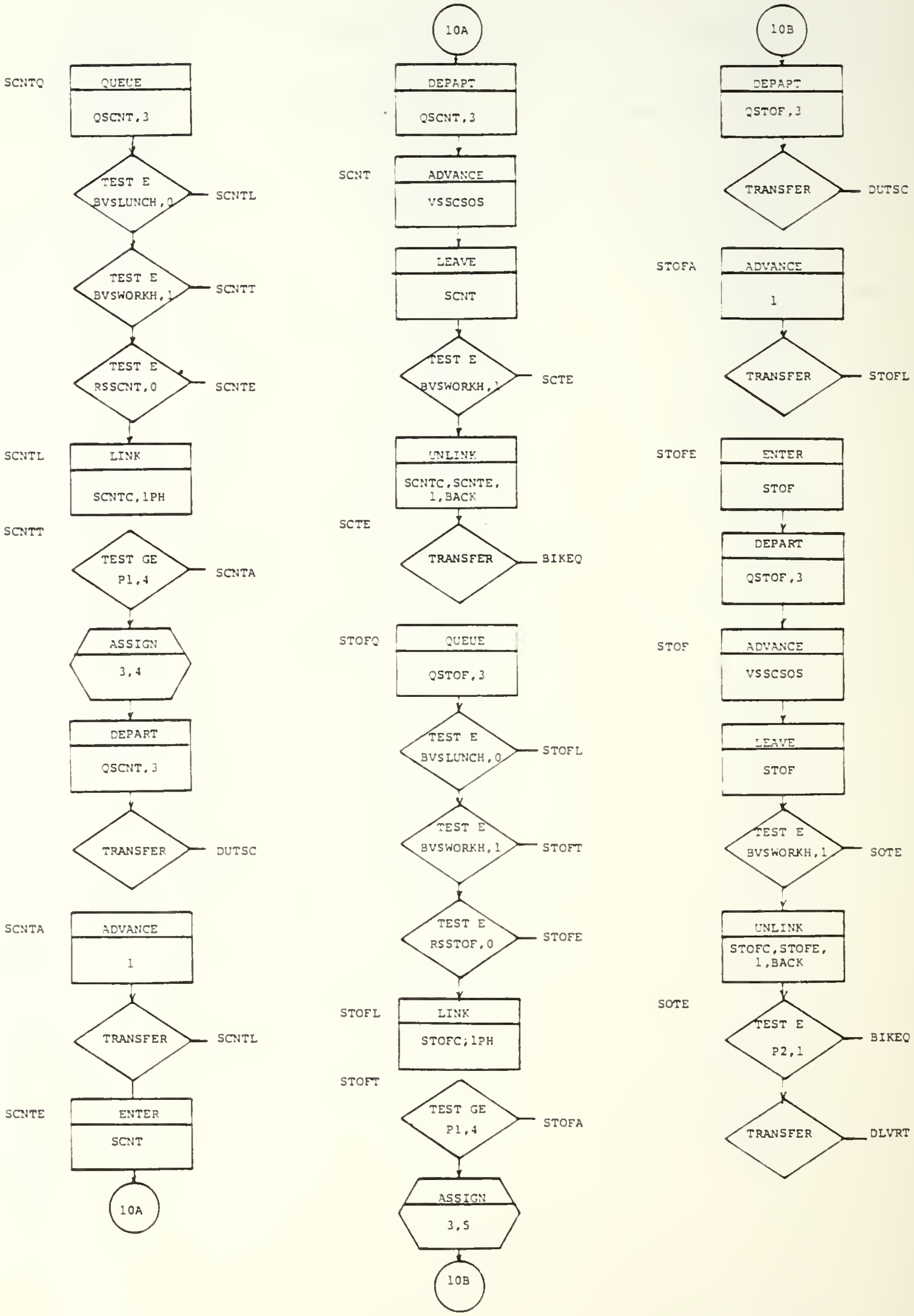
TEST E
BV$LUNCH,0
DEEXL
TEST E
BV$WORKH,1
DEEXT
TEST E
R$DEEX,0
DEEXE
DEEXL
LINK
DEEXC,1PH
DEEXT
TEST GE
P1,4
DEEXA
TEST NE
P8,1
DEEXA
ASSIGN
3,3
DEPART
QDEEX,3
9A
9A
TRANSFER
DUTSC
DEEXA
ADVANCE
1
TRANSFER
DEEXL
DEEXE
ENTER
DEEX
DEPART
QDEEX,3
DEEX
ADVANCE
V$DEEXS
LEAVE
DEEX
ASSIGN
7,1
TEST E
BV$WORKH,1
WRTE
UNLINK
DEEXC, DEEXE,
1,BACK
WRTE
TEST E
P8,1
PRTE
9B
9B
TRANSFER
WRTRM
LOCAS
ASSIGN
2,FN$FTWO
TRANSFER
.V$NOTWR
DESTE
ASSIGN
8,1
DESTE
TEST NE
1,5
BWTAD
TEST NE
P1,7
BWTAD
TEST G
P2,3
STOFQ
TRANSFER
SCNTQ
BWTAD
ADVANCE
FN$FTHSV
TRANSFER
FN
FN$FTHTW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TEST E
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TEST E
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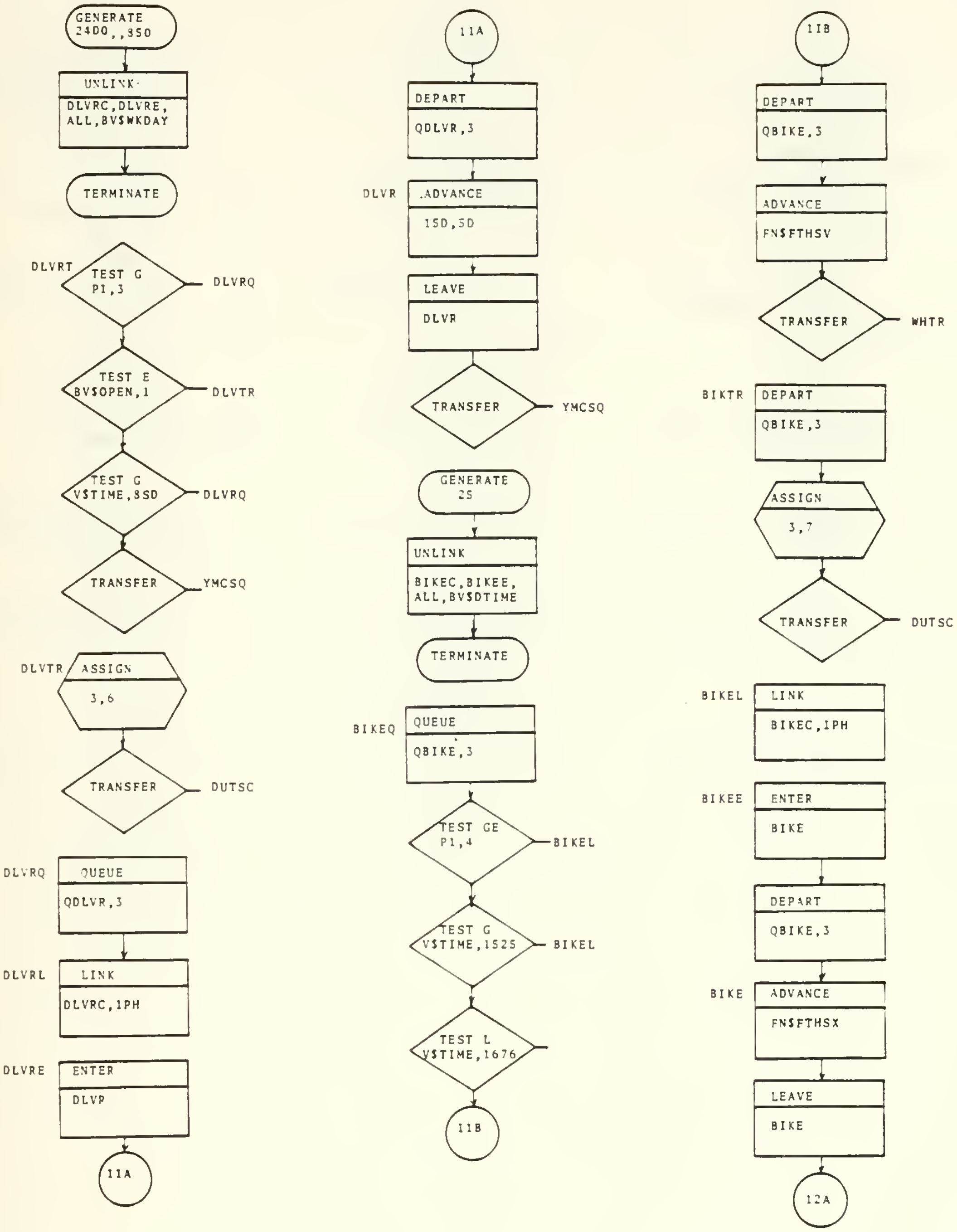
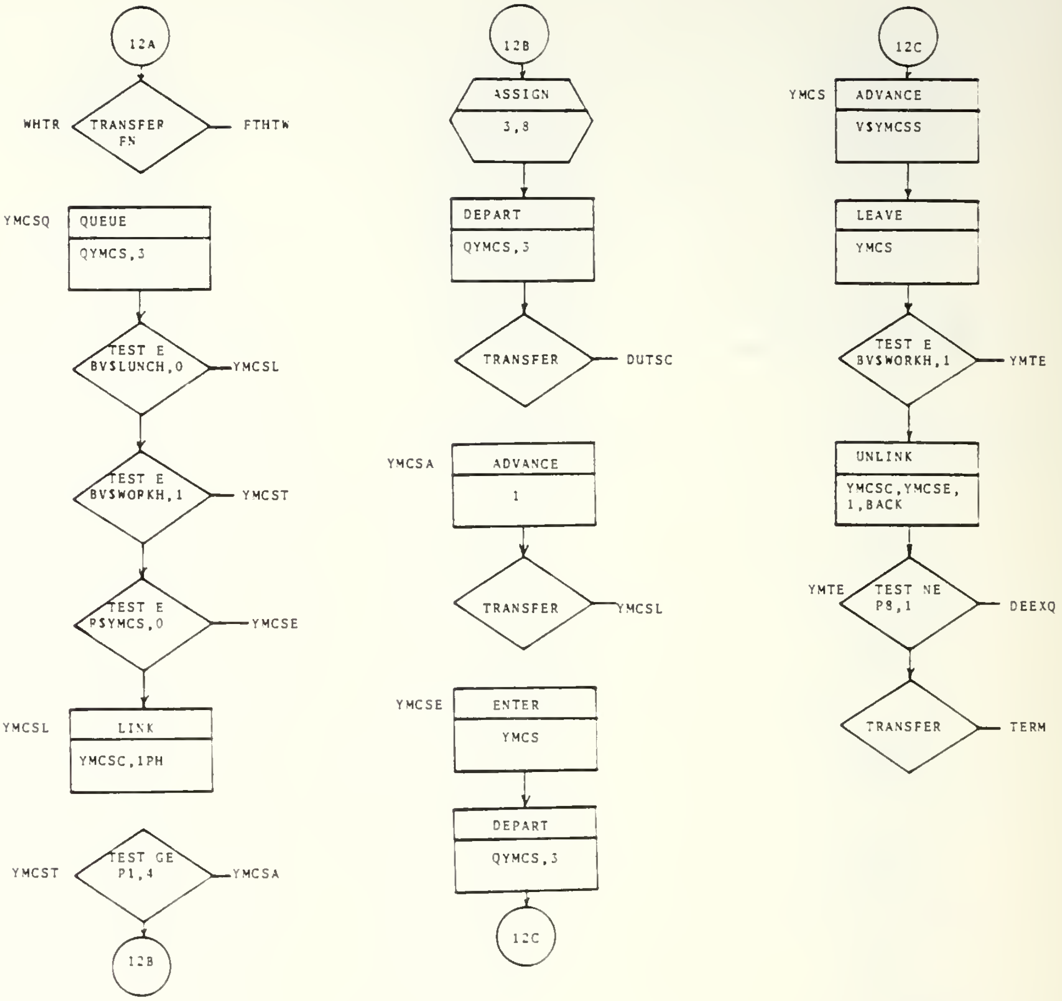
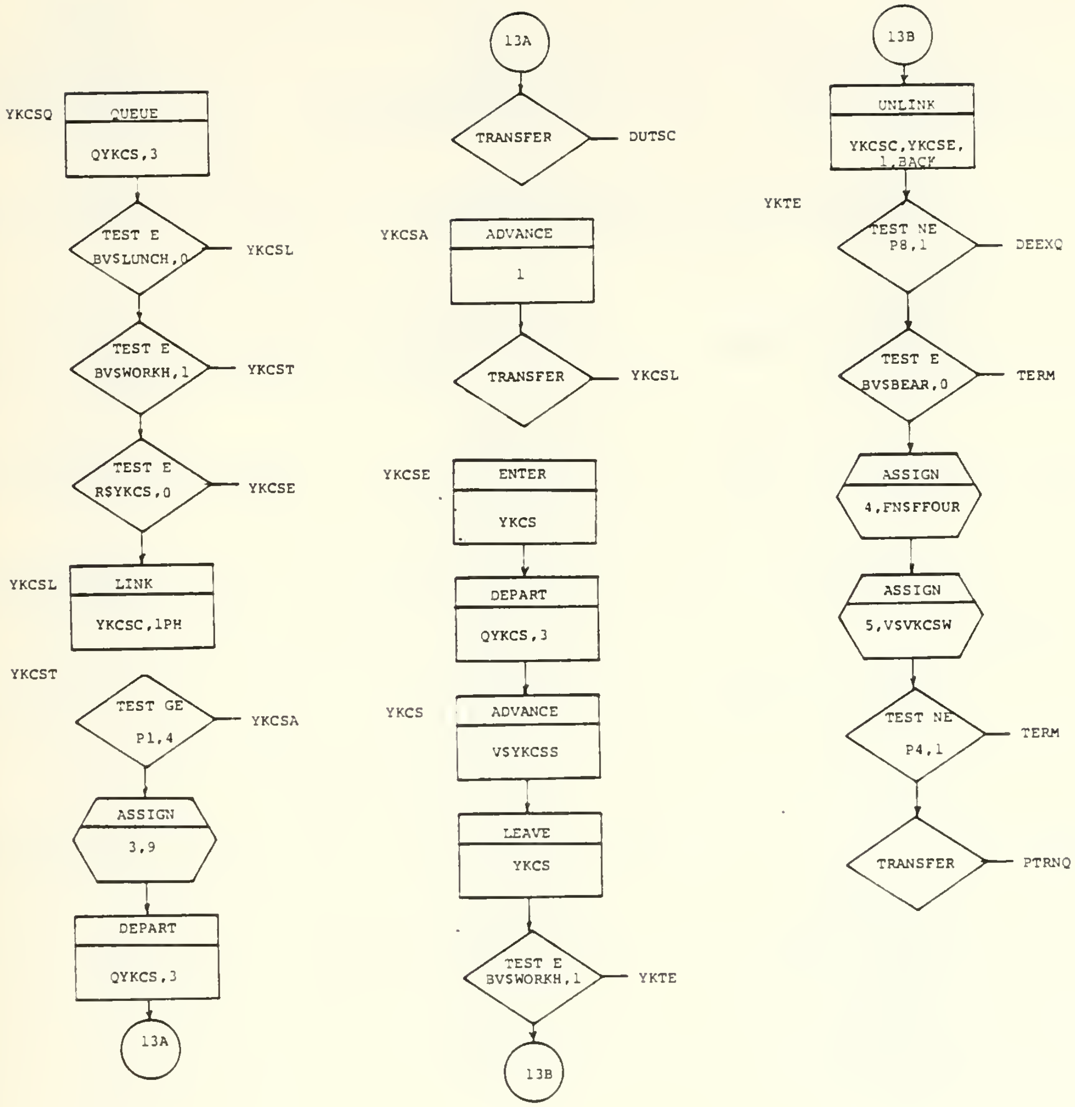
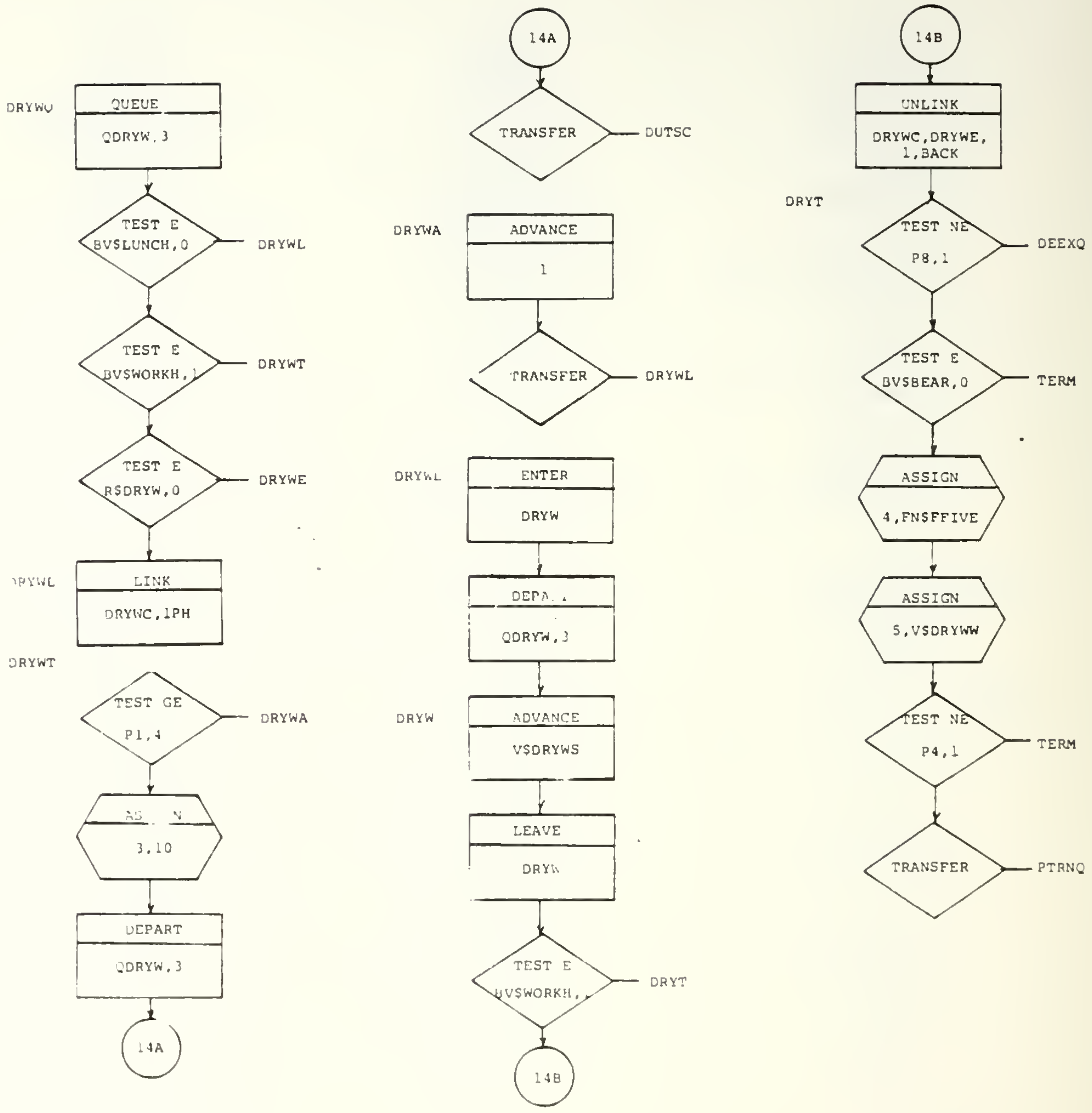
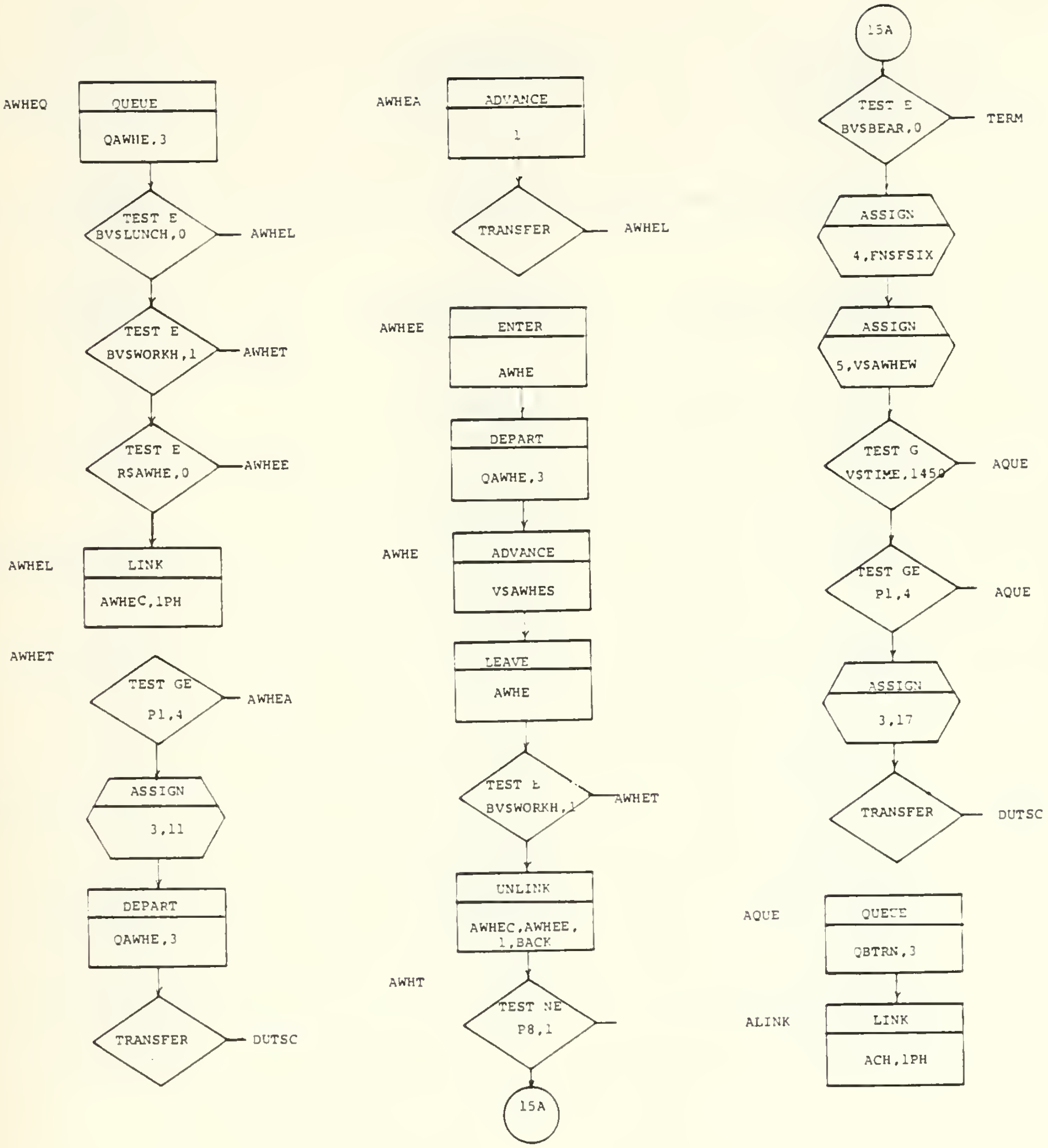
SCNTE
SCNTL
LINK
SCNTC,1PH
SCNTT
TEST GE
P1,4
SCNTA
ASSIGN
3,4
DEPART
QSCNT,3
TRANSFER
DUTSC
SCNTA
ADVANCE
1
TRANSFER
SCNTL
SCNTE
ENTER
SCNT
10A
10A
DEPART
QSCNT,3
SCNT
ADVANCE
VSSCSOS
LEAVE
SCNT
TEST E
BVSWORKH,1
SCTE
UNLINK
SCNTC,SCNTE,
1,BACK
SCTE
TRANSFER
BIKEQ
STOFQ
QUEUE
QSTOF,3
TEST E
BVSLUNCH,0
STOFL
TEST E
BVSWORKH,1
STOFT
TEST E
RSSTOF,0
STOFE
STOFL
LINK
STOFC;1PH
STOFT
TEST GE
P1,4
STOFA
ASSIGN
3,5
10B
10B
DEPART
QSTOF,3
TRANSFER
DUTSC
STOFA
ADVANCE
1
TRANSFER
STOFL
STOFE
ENTER
STOF
DEPART
QSTOF,3
STOF
ADVANCE
VSSCSOS
LEAVE
STOF
TEST E
BVSWORKH,1
SOTE
UNLINK
STOFC,STOFE,
1,BACK
SOTE
TEST E
P2,1
BIKEQ
TRANSFER
DLVRT

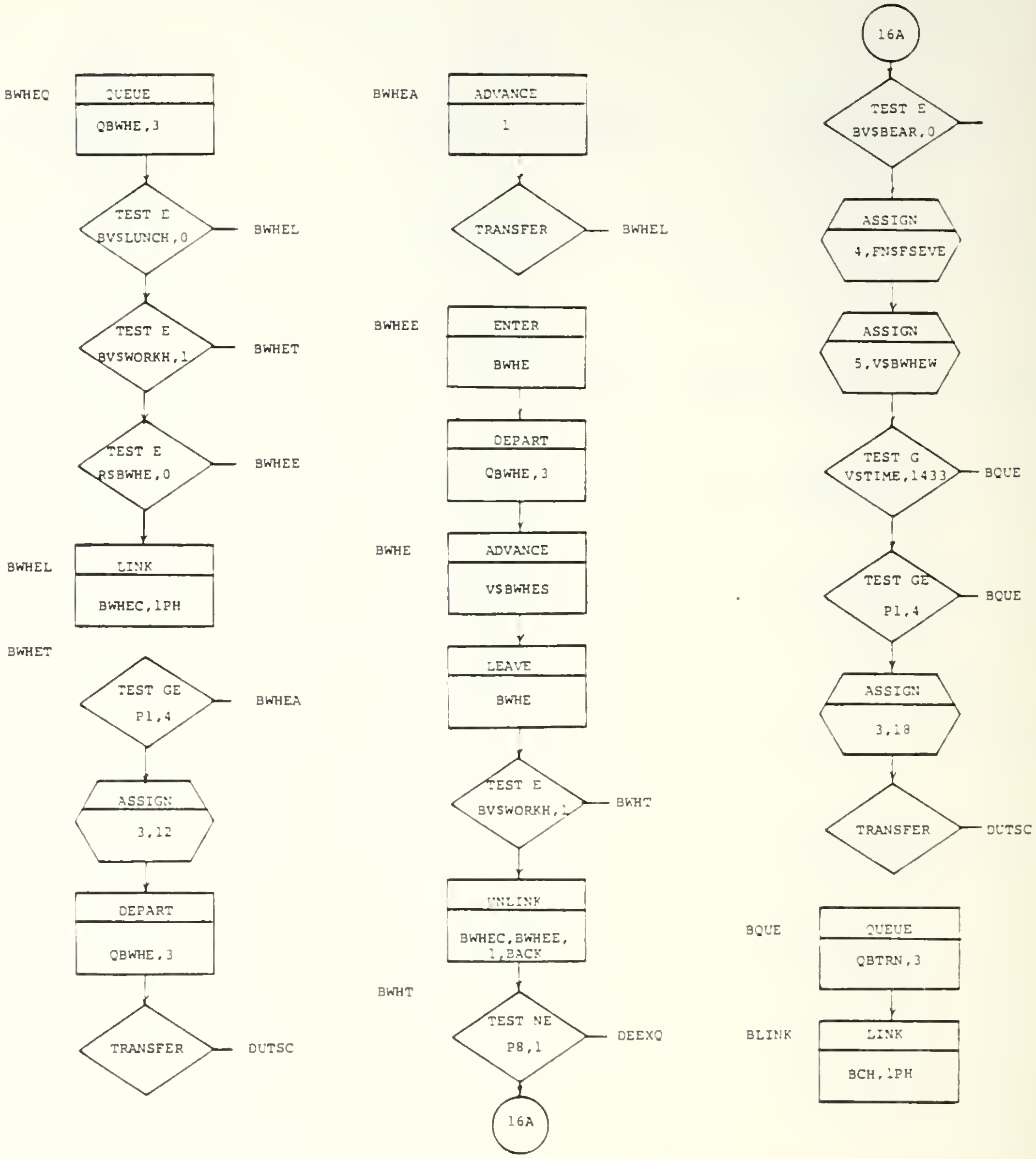

GENERATE
2400,,350
UNLINK
DLVRC,DLVRE,
ALL,BV$WKDAY
TERMINATE
DLVRT
TEST G
P1,3
DLVRQ
TEST E
BV$OPEN,1
DLVTR
TEST G
V$TIME,850
DLVRQ
TRANSFER
YMCSQ
DLVTR
ASSIGN
3,6
TRANSFER
DUTSC
DLVRQ
QUEUE
QDLVR,3
DLVRL
LINK
DLVRC,1PH
DLVRE
ENTER
DLVR
11A
11A
DEPART
QDLVR,3
DLVR
ADVANCE
150,50
LEAVE
DLVR
TRANSFER
YMCSQ
GENERATE
25
UNLINK
BIKEC,BIKEE,
ALL,BV$DTIME
TERMINATE
BIKEQ
QUEUE
QBIKE,3
TEST GE
P1,4
BIKEL
TEST G
V$TIME,1525
BIKEL
TEST L
V$TIME,1676
11B
11B
DEPART
QBIKE,3
ADVANCE
FN$FTHSV
TRANSFER
WHTR
BIKTR
DEPART
QBIKE,3
ASSIGN
3,7
TRANSFER
DUTSC
BIKEL
LINK
BIKEC,1PH
BIKEE
ENTER
BIKE
DEPART
QBIKE,3
BIKE
ADVANCE
FN$FTHSX
LEAVE
BIKE
12A

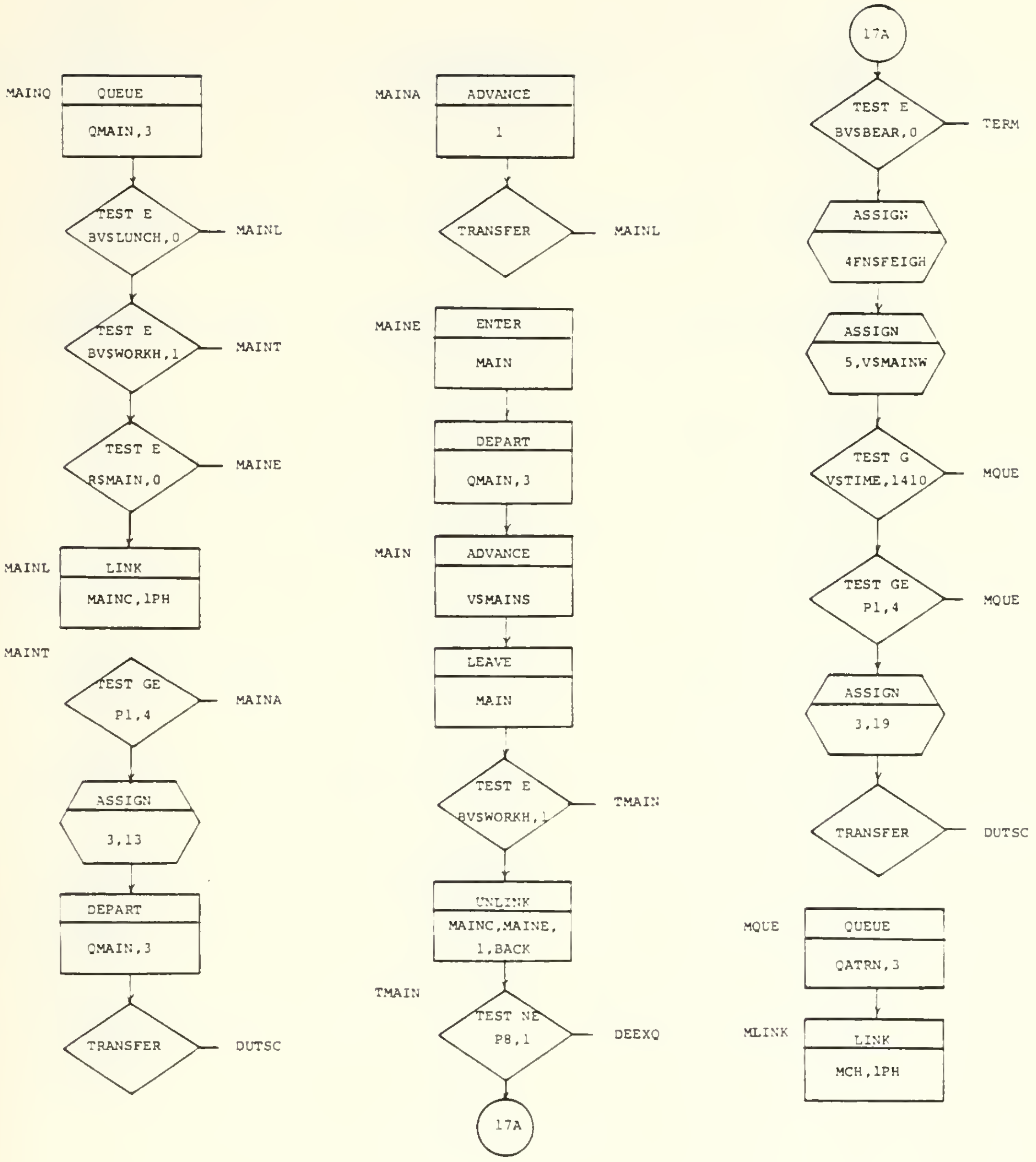

12A
WHTR
TRANSFER
FN
FTHTW
YMCSQ
QUEUE
QYMCS,3
TEST E
BV$LUNCH,0
YMCSL
TEST E
BV$WORKH,1
YMCST
TEST E
P$YMCS,0
YMCSE
YMCSL
LINK
YMCSC,1PH
YMCST
TEST GE
P1,4
YMCSA
12B
12B
ASSIGN
3,8
DEPART
QYMCS,3
TRANSFER
DUTSC
YMCSA
ADVANCE
1
TRANSFER
YMCSL
YMCSE
ENTER
YMCS
DEPART
QYMCS,3
12C
12C
YMCS
ADVANCE
V$YMCSS
LEAVE
YMCS
TEST E
BV$WORKH,1
YMTE
UNLINK
YMCSC,YMCSE,
1,BACK
YMTE
TEST NE
P8,1
DEEXQ
TRANSFER
TERM

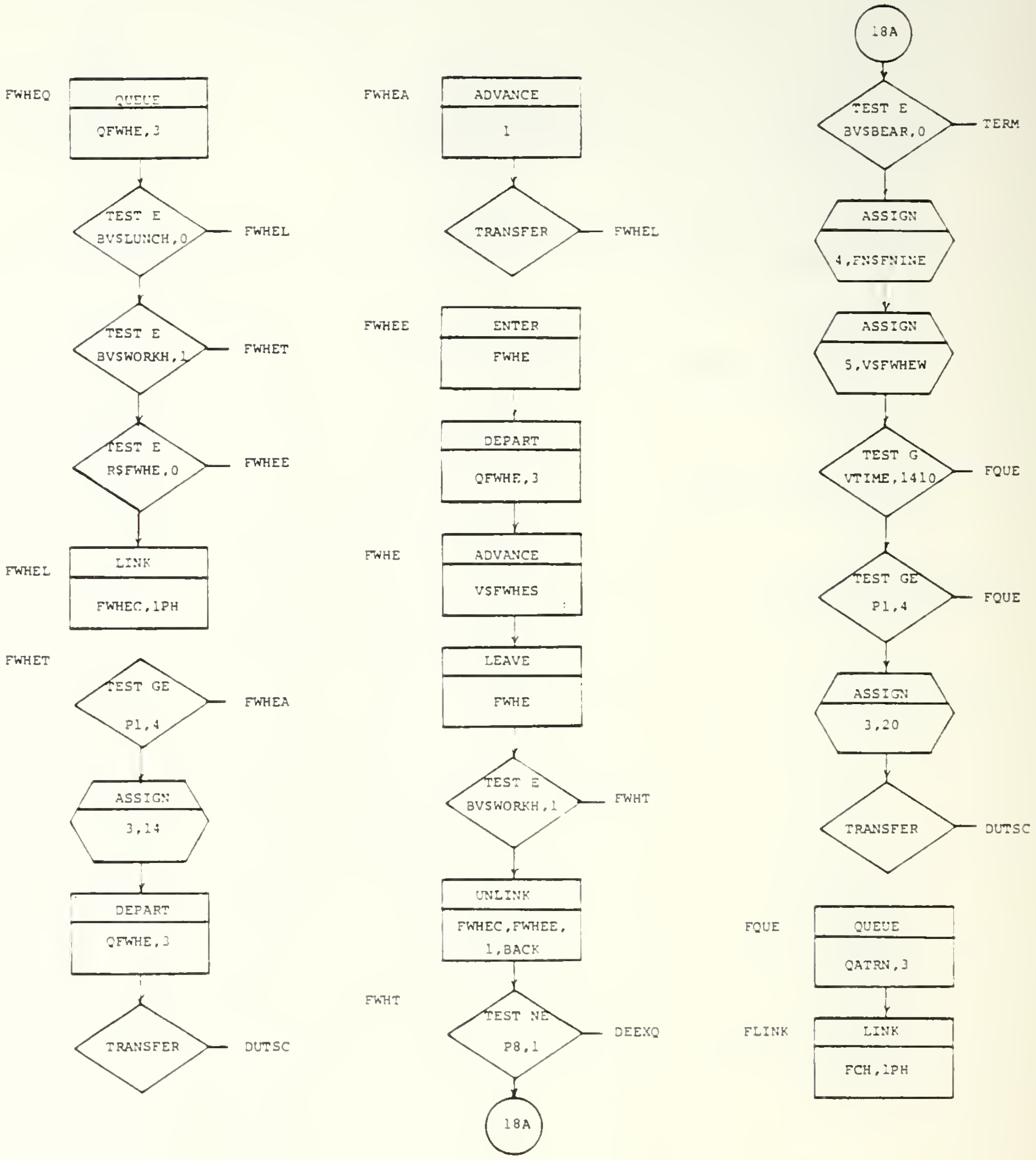

YKCSQ
QUEUE
QYKCS,3
TEST E
BV$LUNCH,0
YKCSL
TEST E
BV$WORKH,1
YKCST
TEST E
R$YKCS,0
YKCSE
YKCSL
LINK
YKCSC,1PH
YKCST
TEST GE
P1,4
YKCSA
ASSIGN
3,9
DEPART
QYKCS,3
13A
13A
TRANSFER
DUTSC
YKCSA
ADVANCE
1
TRANSFER
YKCSL
YKCSE
ENTER
YKCS
DEPART
QYKCS,3
YKCS
ADVANCE
V$YKCSS
LEAVE
YKCS
TEST E
BV$WORKH,1
YKTE
13B
13B
UNLINK
YKCSC,YKCSE,
1,BACK
YKTE
TEST NE
P8,1
DEEXQ
TEST E
BV$BEAR,0
TERM
ASSIGN
4,FN$FFOUR
ASSIGN
5,V$VKCSW
TEST NE
P4,1
TERM
TRANSFER
PTRNQ

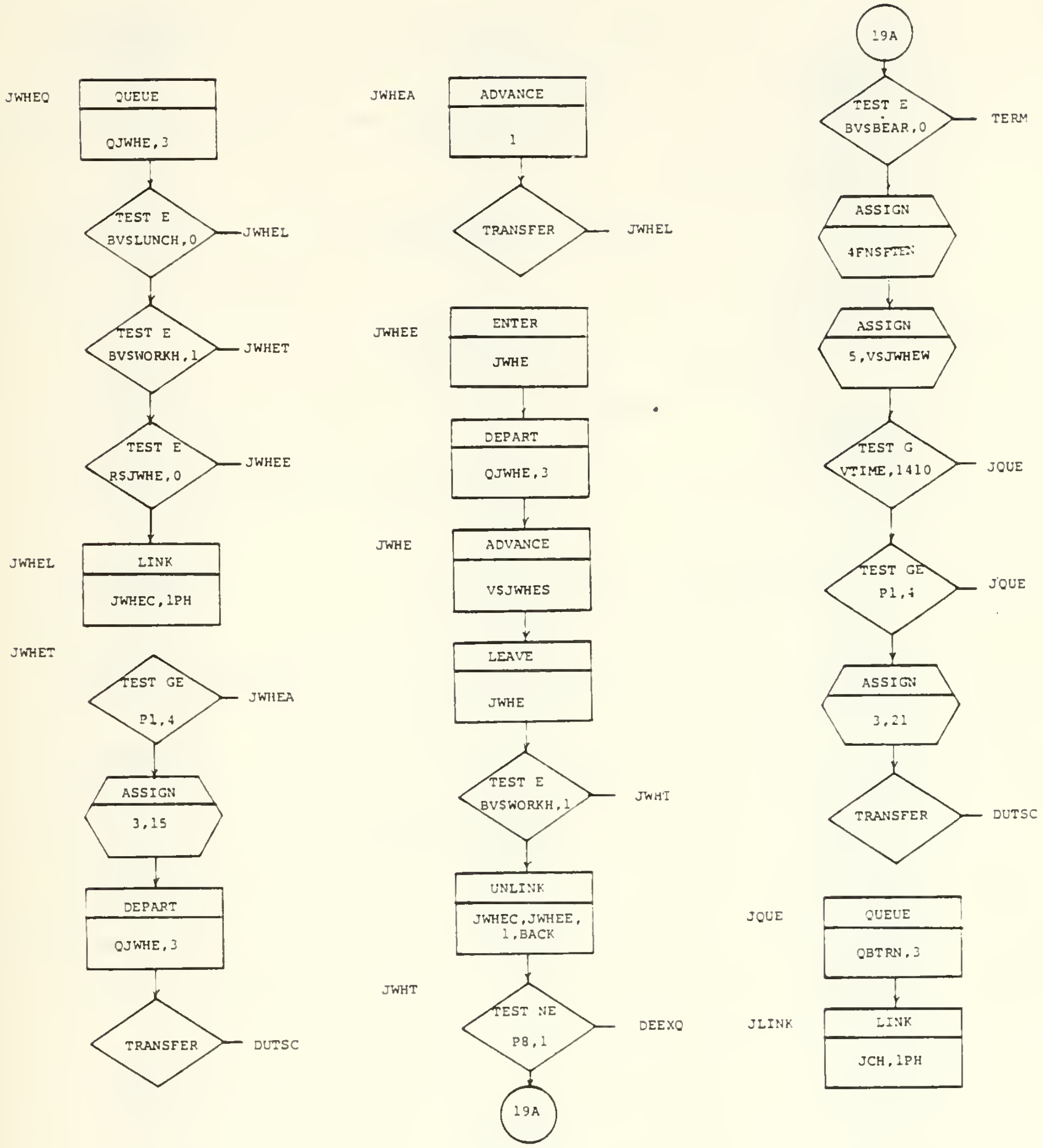

14A
TRANSFER
DUTSC
14B
UNLINK
DRYWC,DRYWE,
1,BACK
DRYWQ
QUEUE
QDRYW,3
TEST E
BV$LUNCH,0
DRYWL
DRYT
TEST NE
P8,1
DEEXQ
DRYWA
ADVANCE
1
TEST E
BV$WORKH,1
DRYWT
TRANSFER
DRYWL
TEST E
BV$BEAR,0
TERM
TEST E
R$DRYW,0
DRYWE
DRYWL
ENTER
DRYW
ASSIGN
4,FN$FFIVE
DRYWL
LINK
DRYWC,1PH
DEPART
QDRYW,3
ASSIGN
5,V$DRYWW
DRYWT
TEST GE
P1,4
DRYWA
DRYW
ADVANCE
V$DRYWS
TEST NE
P4,1
TERM
ASSIGN
3,10
LEAVE
DRYW
TRANSFER
PTRNQ
DEPART
QDRYW,3
TEST E
BV$WORKH,
DRYT
14A
14B

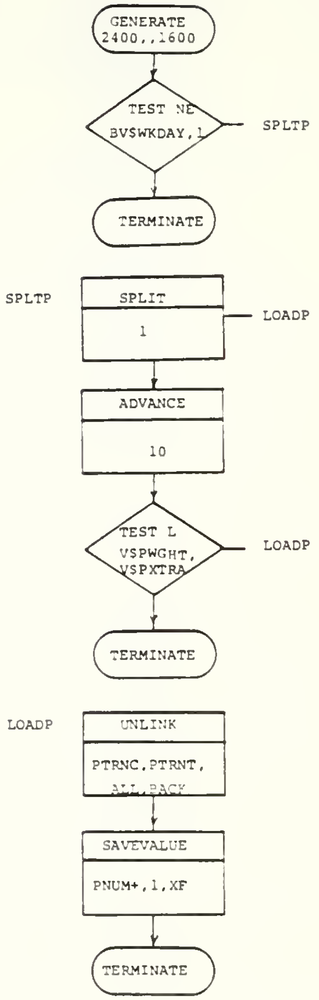

AWHEQ
QUEUE
QAWHE,3
TEST E
BVSLUNCH,0
AWHEL
TEST E
BVSWORKH,1
AWHET
TEST E
R$AWHE,0
AWHEE
AWHEL
LINK
AWHEC,1PH
AWHET
TEST GE
P1,4
AWHEA
ASSIGN
3,11
DEPART
QAWHE,3
TRANSFER
DUTSC
AWHEA
ADVANCE
1
TRANSFER
AWHEL
AWHEE
ENTER
AWHE
DEPART
QAWHE,3
AWHE
ADVANCE
VSAWHES
LEAVE
AWHE
TEST E
BVSWORKH,1
AWHET
UNLINK
AWHEC,AWHEE,
1,BACK
AWHT
TEST NE
P8,1
15A
15A
TEST E
BVSBEAR,0
TERM
ASSIGN
4,FNSFSIX
ASSIGN
5,VSAWHEW
TEST G
V$TIME,1450
AQUE
TEST GE
P1,4
AQUE
ASSIGN
3,17
TRANSFER
DUTSC
AQUE
QUEUE
QBTRN,3
ALINK
LINK
ACH,1PH

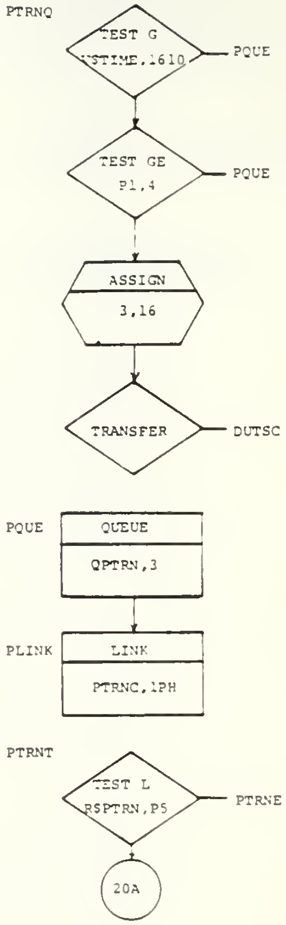

BWHEQ
QUEUE
QBWHE,3
TEST E
BV$LUNCH,0
BWHEL
TEST E
BV$WORKH,1
BWHET
TEST E
R$BWHE,0
BWHEE
BWHEL
LINK
BWHEC,1PH
BWHET
TEST GE
P1,4
BWHEA
ASSIGN
3,12
DEPART
QBWHE,3
TRANSFER
DUTSC
BWHEA
ADVANCE
1
TRANSFER
BWHEL
BWHEE
ENTER
BWHE
DEPART
QBWHE,3
BWHE
ADVANCE
V$BWHES
LEAVE
BWHE
TEST E
BV$WORKH,1
BWHT
UNLINK
BWHEC,BWHEE,
1,BACK
BWHT
TEST NE
P8,1
DEEXQ
16A
16A
TEST E
BV$BEAR,0
ASSIGN
4,FNFEVE
ASSIGN
5,V$BWHEW
TEST G
V$TIME,1433
BQUE
TEST GE
P1,4
BQUE
ASSIGN
3,18
TRANSFER
DUTSC
BQUE
QUEUE
QBTRN,3
BLINK
LINK
BCH,1PH

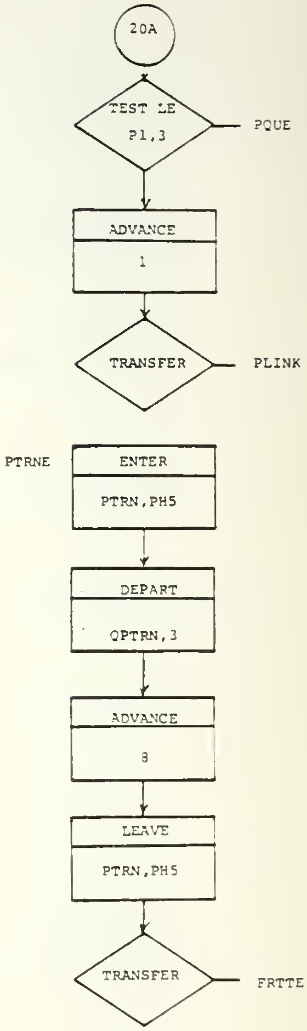

MAINQ
QUEUE
QMAIN,3
TEST E
BVSLUNCH,0
MAINL
TEST E
BV$WORKH,1
MAINT
TEST E
R$MAIN,0
MAINE
MAINL
LINK
MAINC,1PH
MAINT
TEST GE
P1,4
MAINA
ASSIGN
3,13
DEPART
QMAIN,3
TRANSFER
DUTSC
MAINA
ADVANCE
1
TRANSFER
MAINL
MAINE
ENTER
MAIN
DEPART
QMAIN,3
MAIN
ADVANCE
VSMAINS
LEAVE
MAIN
TEST E
BVSWORKH,1
TMAIN
UNLINK
MAINC,MAINE,
1,BACK
TMAIN
TEST NE
P8,1
DEEXQ
17A
17A
TEST E
BVSBEAR,0
TERM
ASSIGN
4FNSFEIGH
ASSIGN
5,VSMAINW
TEST G
VSTIME,1410
MQUE
TEST GE
P1,4
MQUE
ASSIGN
3,19
TRANSFER
DUTSC
MQUE
QUEUE
QATRN,3
MLINK
LINK
MCH,1PH

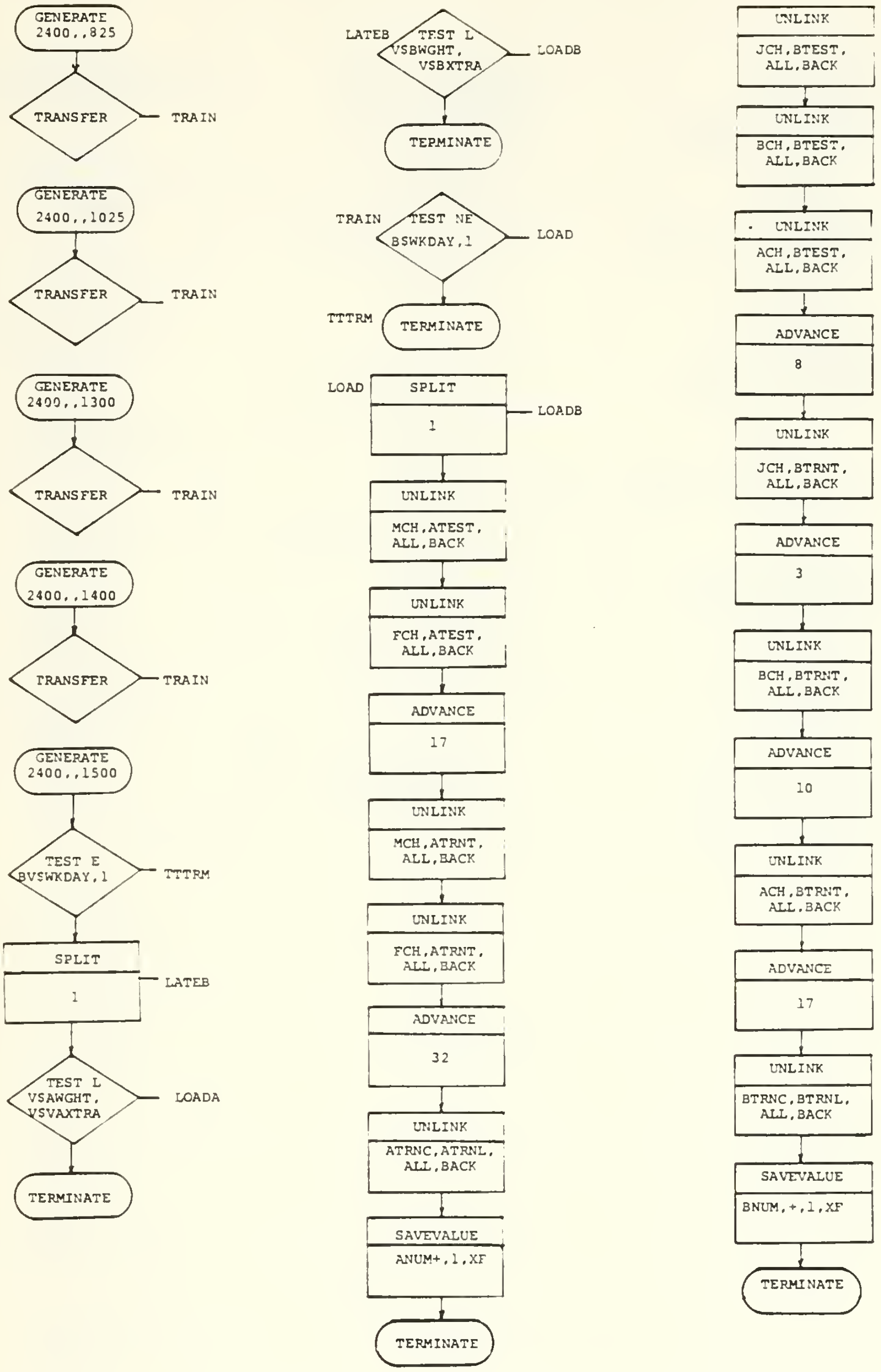

FWHEQ
QUEUE
QFWHE,3
TEST E
BVSLUNCH,0
FWHEL
TEST E
BVSWORKH,1
FWHET
TEST E
R$FWHE,0
FWHEE
FWHEL
LINK
FWHEC,1PH
FWHET
TEST GE
P1,4
FWHEA
ASSIGN
3,14
DEPART
QFWHE,3
TRANSFER
DUTSC
FWHEA
ADVANCE
1
TRANSFER
FWHEL
FWHEE
ENTER
FWHE
DEPART
QFWHE,3
FWHE
ADVANCE
VSFWHES
LEAVE
FWHE
TEST E
BVSWORKH,1
FWHT
UNLINK
FWHEC,FWHEE,
1,BACK
FWHT
TEST NE
P8,1
DEEXQ
18A
18A
TEST E
BVSBEAR,0
TERM
ASSIGN
4,FNSFNINE
ASSIGN
5,VSFWHEW
TEST G
VTIME,1410
FQUE
TEST GE
P1,4
FQUE
ASSIGN
3,20
TRANSFER
DUTSC
FQUE
QUEUE
QATRN,3
FLINK
LINK
FCH,1PH

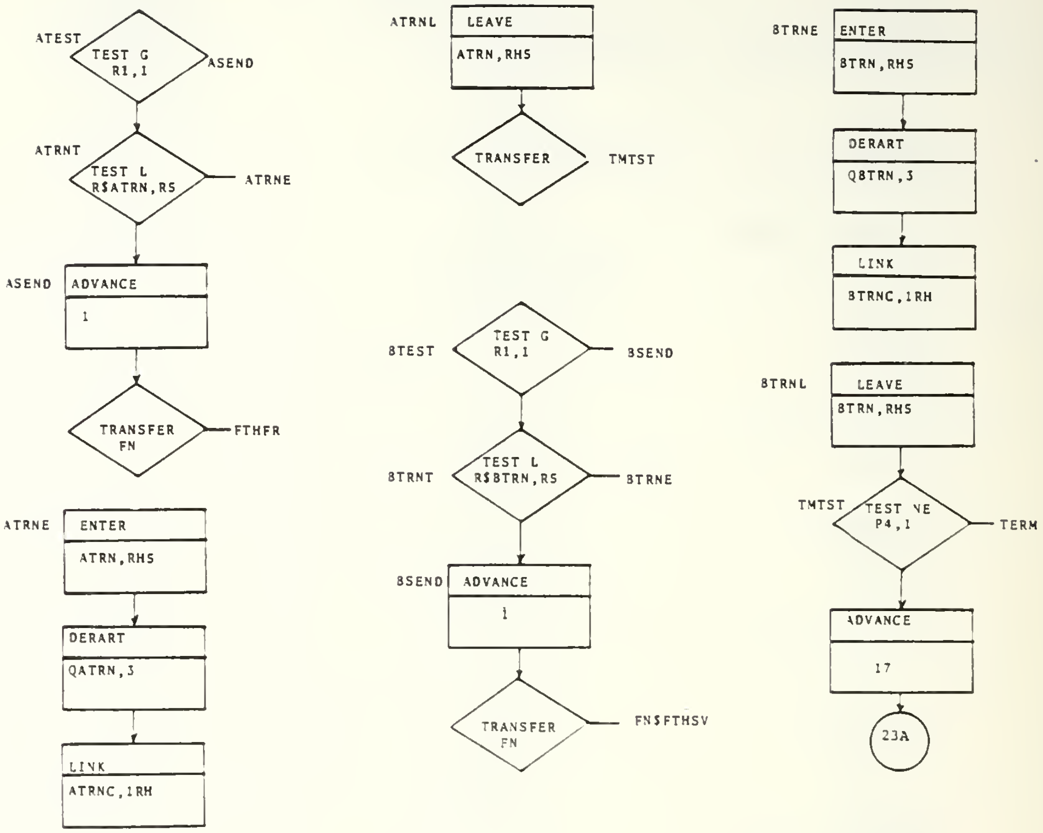

JWHEQ
QUEUE
QJWHE,3
TEST E
BVSLUNCH,0
JWHEL
TEST E
BVSWORKH,1
JWHET
TEST E
RSJWHE,0
JWHEE
JWHEL
LINK
JWHEC,1PH
JWHET
TEST GE
P1,4
JWHEA
ASSIGN
3,15
DEPART
QJWHE,3
TRANSFER
DUTSC
JWHEA
ADVANCE
1
TRANSFER
JWHEL
JWHEE
ENTER
JWHE
DEPART
QJWHE,3
JWHE
ADVANCE
VSJWHES
LEAVE
JWHE
TEST E
BVSWORKH,1
JWHT
UNLINK
JWHEC,JWHEE,
1,BACK
JWHT
TEST NE
P8,1
DEEXQ
19A
19A
TEST E
BVSBEAR,0
TERM
ASSIGN
4FNSFTEN
ASSIGN
5,VSJWHEW
TEST G
VTIME,1410
JQUE
TEST GE
P1,4
JQUE
ASSIGN
3,21
TRANSFER
DUTSC
JQUE
QUEUE
QBTRN,3
JLINK
LINK
JCH,1PH

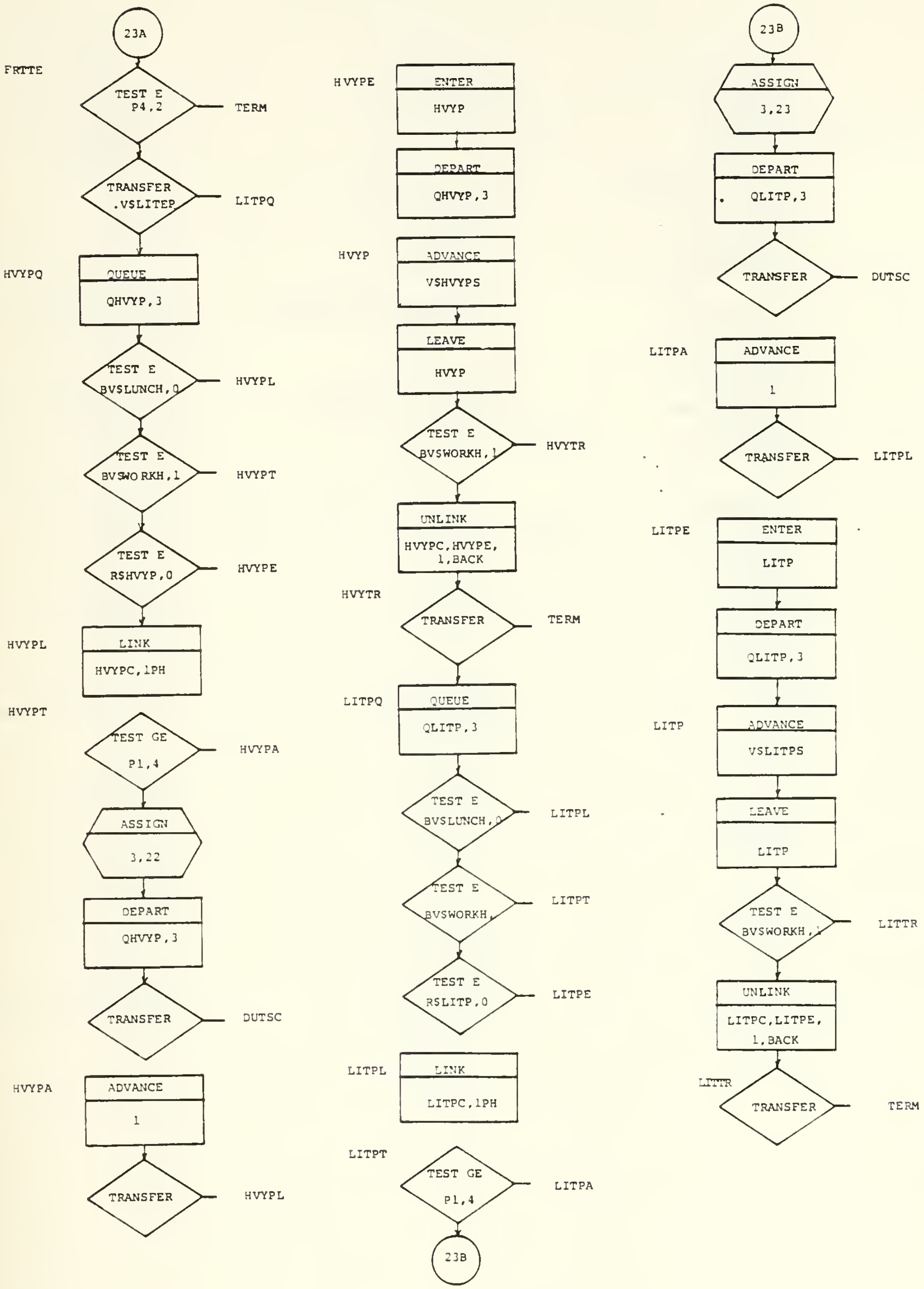

GENERATE
2400,,1600
TEST NE
BV$WKDAY,1
SPLTP
TERMINATE
SPLTP
SPLIT
1
LOADP
ADVANCE
10
TEST L
V$PWGHT,
V$PXTRA
LOADP
TERMINATE
LOADP
UNLINK
PTRNC,PTRNT,
ALL,BACK
SAVEVALUE
PNUM+,1,XF
TERMINATE

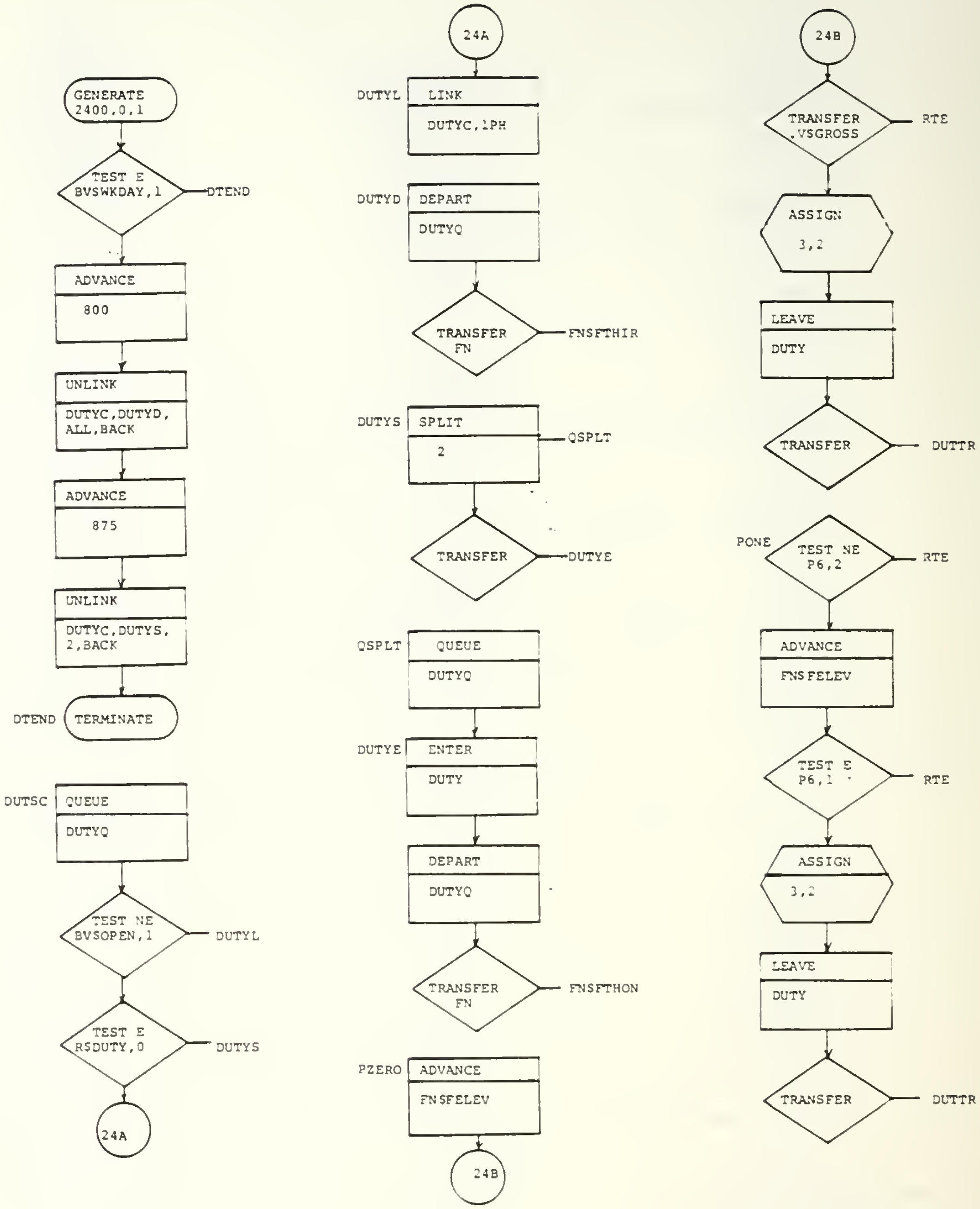

PTRNQ
TEST G
C$TIME,1610
PQUE
TEST GE
P1,4
PQUE
ASSIGN
3,16
TRANSFER
DUTSC
PQUE
QUEUE
QPTRN,3
PLINK
LINK
PTRNC,1PH
PTRNT
TEST L
R$PTRN,P5
PTRNE
20A

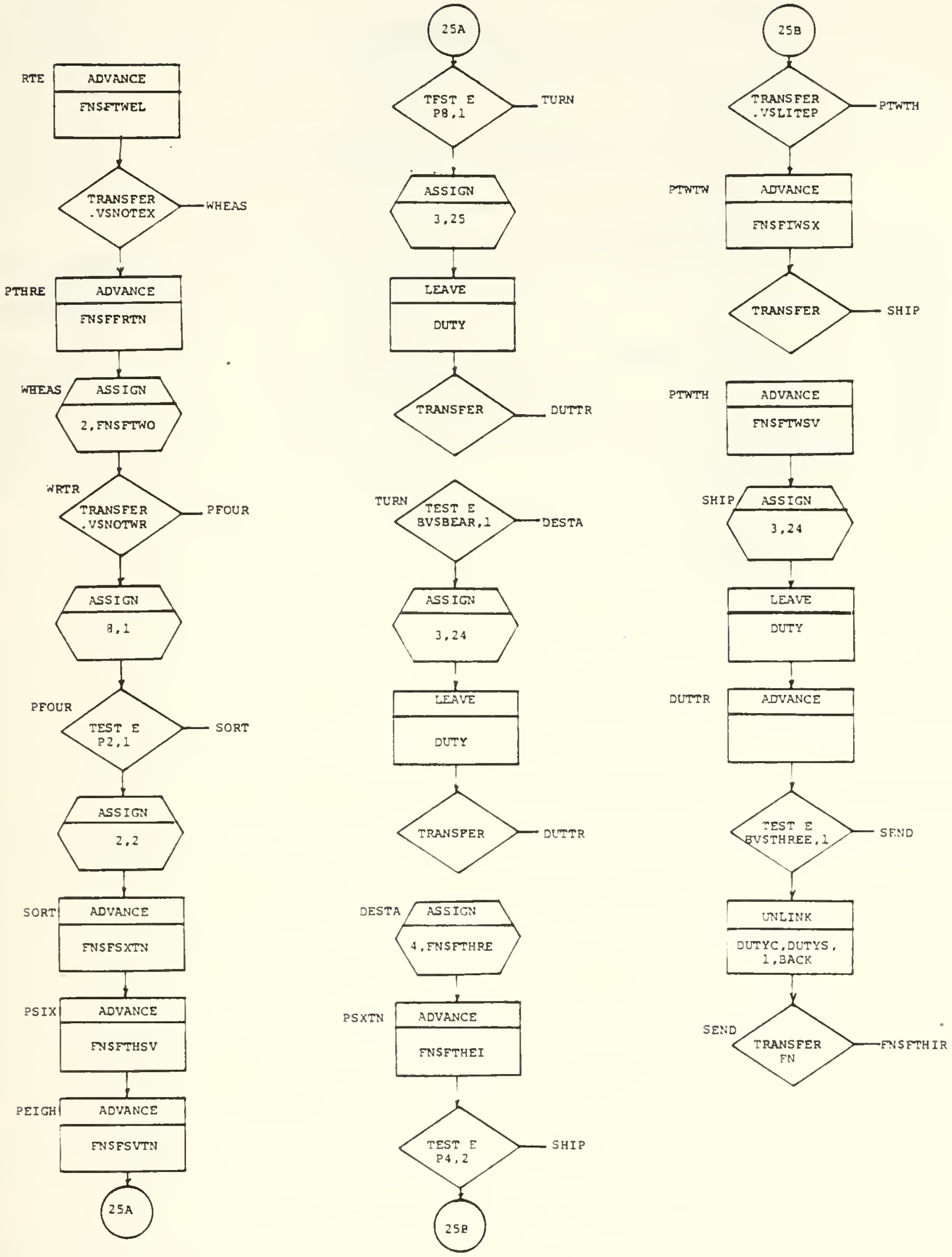

20A
TEST LE
P1,3
PQUE
ADVANCE
1
TRANSFER
PLINK
PTRNE
ENTER
PTRN,PH5
DEPART
QPTRN,3
ADVANCE
8
LEAVE
PTRN,PH5
TRANSFER
FRTTE

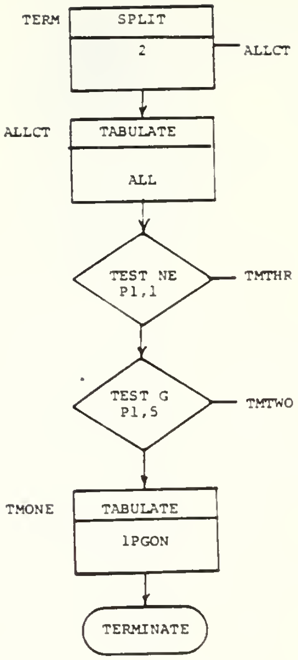

GENERATE 2400,,825
TRANSFER
TRAIN
GENERATE 2400,,1025
TRANSFER
TRAIN
GENERATE 2400,,1300
TRANSFER
TRAIN
GENERATE 2400,,1400
TRANSFER
TRAIN
GENERATE 2400,,1500
TEST E BVSWKDAY,1
TTTRM
SPLIT
1
LATEB
TEST L VSAWGHT, VSVAXTRA
LOADA
TERMINATE
LATEB
TEST L VSBWGHT, VSBXTRA
LOADB
TERMINATE
TRAIN
TEST NE BSWKDAY,1
LOAD
TTTRM
TERMINATE
LOAD
SPLIT
1
LOADB
UNLINK
MCH,ATEST, ALL,BACK
UNLINK
FCH,ATEST, ALL,BACK
ADVANCE
17
UNLINK
MCH,ATRNT, ALL,BACK
UNLINK
FCH,ATRNT, ALL,BACK
ADVANCE
32
UNLINK
ATRNC,ATRNL, ALL,BACK
SAVEVALUE
ANUM+,1,XF
TERMINATE
UNLINK
JCH,BTEST, ALL,BACK
UNLINK
BCH,BTEST, ALL,BACK
UNLINK
ACH,BTEST, ALL,BACK
ADVANCE
8
UNLINK
JCH,BTRNT, ALL,BACK
ADVANCE
3
UNLINK
BCH,BTRNT, ALL,BACK
ADVANCE
10
UNLINK
ACH,BTRNT, ALL,BACK
ADVANCE
17
UNLINK
BTRNC,BTRNL, ALL,BACK
SAVEVALUE
BNUM,+,1,XF
TERMINATE

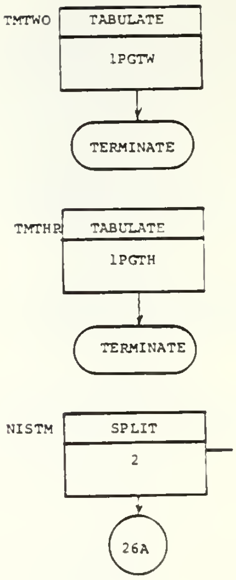

ATEST
TEST G
R1,1
ASEND
ATRNT
TEST L
R$ATRN,R5
ATRNE
ASEND
ADVANCE
1
TRANSFER
FN
FTHFR
ATRNE
ENTER
ATRN,RHS
DERART
QATRN,3
LINK
ATRNC,1RH
ATRNL
LEAVE
ATRN,RHS
TRANSFER
TMTST
BTEST
TEST G
R1,1
BSEND
BTRNT
TEST L
R$BTRN,R5
BTRNE
BSEND
ADVANCE
1
TRANSFER
FN
FN$FTHSV
BTRNE
ENTER
BTRN,RHS
DERART
QBTRN,3
LINK
BTRNC,1RH
BTRNL
LEAVE
BTRN,RHS
TMTST
TEST NE
P4,1
TERM
ADVANCE
17
23A

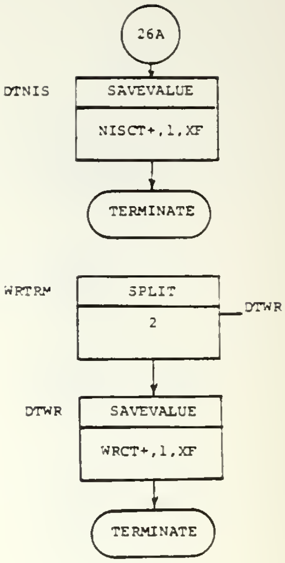

23A
FRTTE
TEST E P4,2
TERM
TRANSFER .V$LITEP
LITPQ
HVYPQ
QUEUE
QHVYP,3
TEST E BV$LUNCH,0
HVYPL
TEST E BV$WORKH,1
HVYPT
TEST E R$HVYP,0
HVYPE
HVYPL
LINK
HVYPC,1PH
HVYPT
TEST GE P1,4
HVYPA
ASSIGN
3,22
DEPART
QHVYP,3
TRANSFER
DUTSC
HVYPA
ADVANCE
1
TRANSFER
HVYPL
HVYPE
ENTER
HVYP
DEPART
QHVYP,3
HVYP
ADVANCE
V$HVYPS
LEAVE
HVYP
TEST E BV$WORKH,1
HVYTR
UNLINK
HVYPC,HVYPE, 1,BACK
HVYTR
TRANSFER
TERM
LITPQ
QUEUE
QLITP,3
TEST E BV$LUNCH,0
LITPL
TEST E BV$WORKH,
LITPT
TEST E R$LITP,0
LITPE
LITPL
LINK
LITPC,1PH
LITPT
TEST GE P1,4
LITPA
23B
23B
ASSIGN
3,23
DEPART
QLITP,3
TRANSFER
DUTSC
LITPA
ADVANCE
1
TRANSFER
LITPL
LITPE
ENTER
LITP
DEPART
QLITP,3
LITP
ADVANCE
V$LITPS
LEAVE
LITP
TEST E BV$WORKH,1
LITTR
UNLINK
LITPC,LITPE, 1,BACK
LITTR
TRANSFER
TERM


GENERATE
2400,0,1
TEST E
BVSWKDAY,1
DTEND
ADVANCE
800
UNLINK
DUTYC,DUTYD,
ALL,BACK
ADVANCE
875
UNLINK
DUTYC,DUTYS,
2,BACK
DTEND
TERMINATE
DUTSC
QUEUE
DUTYQ
TEST NE
BVSOPEN,1
DUTYL
TEST E
R$DUTY,0
DUTYS
24A
24A
DUTYL
LINK
DUTYC,1PH
DUTYD
DEPART
DUTYQ
TRANSFER
FN
FN$FTHIR
DUTYS
SPLIT
2
QSPLT
TRANSFER
DUTYE
QSPLT
QUEUE
DUTYQ
DUTYE
ENTER
DUTY
DEPART
DUTYQ
TRANSFER
FN
FN$FTHON
PZERO
ADVANCE
FN$FELEV
24B
24B
TRANSFER
.V$GROSS
RTE
ASSIGN
3,2
LEAVE
DUTY
TRANSFER
DUTTR
PONE
TEST NE
P6,2
RTE
ADVANCE
FN$FELEV
TEST E
P6,1
RTE
ASSIGN
3,2
LEAVE
DUTY
TRANSFER
DUTTR


RTE
ADVANCE
FNSFTWEL
TRANSFER
.VSNOTEX
WHEAS
PTHRE
ADVANCE
FNSFFRTN
WHEAS
ASSIGN
2,FNSFTWO
WRTR
TRANSFER
.VSNOTWR
PFOUR
ASSIGN
8,1
PFOUR
TEST E
P2,1
SORT
ASSIGN
2,2
SORT
ADVANCE
FNSFSXTN
PSIX
ADVANCE
FNSFTHSV
PEIGH
ADVANCE
FNSFSVTN
25A
25A
TEST E
P8,1
TURN
ASSIGN
3,25
LEAVE
DUTY
TRANSFER
DUTTR
TURN
TEST E
BVSBEAR,1
DESTA
ASSIGN
3,24
LEAVE
DUTY
TRANSFER
DUTTR
DESTA
ASSIGN
4,FNSFTHRE
PSXTN
ADVANCE
FNSFTHEI
TEST E
P4,2
SHIP
25B
25B
TRANSFER
.VSLITEP
PTWTH
PTWTW
ADVANCE
FNSFTWSX
TRANSFER
SHIP
PTWTH
ADVANCE
FNSFTWSV
SHIP
ASSIGN
3,24
LEAVE
DUTY
DUTTR
ADVANCE
TEST E
BVSTHREE,1
SEND
UNLINK
DUTYC,DUTYS,
1,BACK
SEND
TRANSFER
FN
FNSFTHIR


TERM
SPLIT
2
ALLCT
ALLCT
TABULATE
ALL
TEST NE
P1,1
TMTHR
TEST G
P1,5
TMTWO
TMONE
TABULATE
1PGON
TERMINATE


TMTWO
TABULATE
1PGTW
TERMINATE
TMTHR
TABULATE
1PGTH
TERMINATE
NISTM
SPLIT
2
26A


26A
DTNIS
SAVEVALUE
NISCT+,1,XF
TERMINATE
WRTRM
SPLIT
2
DTWR
DTWR
SAVEVALUE
WRCT+,1,XF
TERMINATE

APPENDIX C

PROGRAM OUTPUT

TABLE OF CONTENTS

Block Counts 126

User Chains. 130

Storages 131

Queues 132

Tables 133

Savevalues 135

```
THIS IS SNAP     4 OF     4

RELATIVE CLOCK        67200  ABSOLUTE CLOCK       100800
BLOCK COUNTS
BLOCK CURRENT     TOTAL     BLOCK CURRENT     TOTAL     BLOCK CURRENT     TOTAL     BLOCK CURRENT     TOTAL     BLOCK CURRENT     TOTAL
    1       0         4        11       0        20        21       0        20        31       0        60        41       0        60
    2       0         4        12       0        20        22       0        20        32       0        60        42       0        60
    3       0        28        13       0        20        23       0        20        33       0        60        43       0        40
    4       0        28        14       0        20        24       0        20        34       0        60        44       0        40
    5       0        20        15       0        20        25       0        28        35       0        60        45       0        40
    6       0        20        16       0        20        26       0        60        36       0        60        46       0        40
    7       0        20        17       0        20        27       0        60        37       0        60        47       0        40
    8       0        20        18       0        20        28       0        60        38       0        60        48       0        40
    9       0        20        19       0        20        29       0        60        39       0        60        49       0        40
   10       0        20        20       0        20        30       0        60        40       0        60        50       0        40

BLOCK CURRENT     TOTAL     BLOCK CURRENT     TOTAL     BLOCK CURRENT     TOTAL     BLOCK CURRENT     TOTAL     BLOCK CURRENT     TOTAL
   51       0        40        61       0        20        71       0        20        81       0        40        91       0        40
   52       0        40        62       0        20        72       0        20        82       0        40        92       0        40
   53       0        40        63       0        20        73       0        20        83       0        40        93       0        28
   54       0        40        64       0        20        74       0        20        84       0        40        94       0        28
   55       0        40        65       0        20        75       0        20        85       0        40        95       0       704
   56       0        40        66       0        20        76       0        40        86       0        40        96       0       704
   57       0        40        67       0        20        77       0        40        87       0        40        97       0       704
   58       0        40        68       0        20        78       0        40        88       0        40        98       0        28
   59       0        40        69       0        20        79       0        40        89       0        40        99       0        28
   60       0        20        70       0        20        80       0        40        90       0        40       100       0     10904


BLOCK CURRENT     TOTAL     BLOCK CURRENT     TOTAL     BLOCK CURRENT     TOTAL     BLOCK CURRENT     TOTAL     BLOCK CURRENT     TOTAL
  101       0     10904       111       0      1012       121       0       173       131       0      8800       141       0       672
  102       0     10904       112       0      1012       122       0       173       132       0     13260       142       0       461
  103       0        28       113       0        44       123       0       173       133       0      7322       143       0        10
  104       0        28       114       0     13260       124       0       173       134       0      4815       144       0        10
  105       0       640       115       0     13260       125       0      4287       135       0      1646       145       0        10
  106       0       640       116       0     13260       126       0      4287       136       0      1646       146       0       451
  107       0       640       117       0     13260       127       0      4287       137       0      2507       147       0       451
  108       0        28       118       0     13260       128       0      4287       138       0      2507       148       0      2489
  109       0        28       119       0     13260       129       0      8800       139       0      2315       149       0      2489
  110       0      1012       120       0      4460       130       0      8800       140       0      1854       150       0      2489
```

```
BLOCK CURRENT   TOTAL   BLOCK CURRENT   TOTAL   BLOCK CURRENT   TOTAL   BLOCK CURRENT   TOTAL   BLOCK CURRENT   TOTAL
  151     0      2489     161     0      1746     171     0      1766     181     0      4655     191     0      9277
  152     0      2489     162     0        98     172     0      1766     182     0      4655     192     0      2688
  153     0      2470     163     0        31     173     0      1766     183     0      4655     193     0      2688
  154     0      2489     164     0        24     174     0      1752     184     0      4655     194     0      2688
  155     0      1627     165     0        24     175     0      1766     185     0      4655     195     0      2688
  156     0      1627     166     0        24     176     0        41     186     0      4624     196     0     13440
  157     0      4815     167     0         7     177     0      4652     187     0      4655     197     0     13440
  158     0      1790     168     0         7     178     0      4652     188     0      1593     198     0     13440
  159     0      1790     169     0      1766     179     0      3532     189     0      5938     199     0      6931
  160     0      1777     170     0      1766     180     0      2053     190     0      9574     200     0      6931


BLOCK CURRENT   TOTAL   BLOCK CURRENT   TOTAL   BLOCK CURRENT   TOTAL   BLOCK CURRENT   TOTAL   BLOCK CURRENT   TOTAL
  201     0      4772     211     0      2642     221     0       523     231     0       906     241     0      8574
  202     0      2159     212     0      2642     222     0         1     232     0       906     242     0      8571
  203     0      6946     213     0      2642     223     0         1     233     0       906     243     0      5953
  204     0      6946     214     0      9588     224     0         1     234     0       904     244     1       135
  205     0      6946     215     0      8708     225     0         1     235     0       906     245     0       134
  206     0      6946     216     0       905     226     0       522     236     0        23     246     0      5953
  207     0      6946     217     0       905     227     0       522     237     0      8706     247     0      5953
  208     0      2643     218     0       854     228     0       906     238     0      8706     248     0      5584
  209     0      2643     219     0       331     229     0       906     239     0        25     249     0      2111
  210     0      2642     220     0       615     230     0       906     240     0      8706     250     0      4886

BLOCK CURRENT   TOTAL   BLOCK CURRENT   TOTAL   BLOCK CURRENT   TOTAL   BLOCK CURRENT   TOTAL   BLOCK CURRENT   TOTAL
  251     0      3473     261     0      5940     271     0         4     281     0      2619     291     0         1
  252     0        10     262     0      5924     272     0         4     282     0      1445     292     0      1431
  253     0        10     263     0      5940     273     0      1546     283     0        28     293     0      1431
  254     0        10     264     0      2618     274     0      1546     284     0        28     294     0      1426
  255     0      3463     265     0      2618     275     0      2619     285     0        28     295     0      1426
  256     0      3463     266     0      2461     276     0      2619     286     0      1445     296     0      1426
  257     0      5940     267     0       913     277     0      2619     287     0        14     297     0      1426
  258     0      5940     268     0      2337     278     0      2619     288     0        13     298     0      1426
  259     0      5940     269     0      1550     279     0      2619     289     0        13     299     0      2688
  260     0      5940     270     0         4     280     0      2611     290     0         1     300     0      2688

BLOCK CURRENT   TOTAL   BLOCK CURRENT   TOTAL   BLOCK CURRENT   TOTAL   BLOCK CURRENT   TOTAL   BLOCK CURRENT   TOTAL
  301     0      2688     311     0         2     321     0      1451     331     0      1453     341     0       232
  302     0      7114     312     0      7092     322     0      1206     332     0      1453     342     0         2
  303     0      7114     313     0      7100     323     0         9     333     0      1453     343     0         2
  304     0        84     314     0      7100     324     0         9     334     0      1262     344     0         2
  305     0        22     315     0      7100     325     0         9     335     0      1453     345     0         2
  306     0        20     316     0      7100     326     0         9     336     0      1451     346     0         0
  307     0        20     317     0      7120     327     0         0     337     0       508     347     0         0
  308     0        20     318     0      1462     328     0         0     338     0       508     348     0       506
  309     0         2     319     0      1462     329     0      1453     339     0       508     349     0       506
  310     0         2     320     0      1460     330     0      1453     340     0       506     350     0       506
```

```
BLOCK CURRENT    TOTAL    BLOCK CURRENT    TOTAL    BLOCK CURRENT    TOTAL    BLOCK CURRENT    TOTAL    BLOCK CURRENT    TOTAL
  351       0      506      361       0      682      371       0      679      381       0      665      391       0        0
  352       0      506      362       0      681      372       0      679      382       0      253      392       0       16
  353       0      417      363       0      678      373       0      679      383       0      446      393       0       16
  354       0      506      364       0      537      374       0      679      384       0      446      394       0      446
  355       0      505      365       0        3      375       0      679      385       0      446      395       0      446
  356       0      497      366       0        3      376       0      641      386       0      446      396       0      446
  357       0      497      367       0        3      377       0      679      387       0      389      397       0      446
  358       0      497      368       0        3      378       0      677      388       0       16      398       0      446
  359       0       36      369       0        0      379       0      665      389       0        0      399       0      391
  360       0      682      370       0        0      380       0      665      390       0        0      400       0      446

BLOCK CURRENT    TOTAL    BLOCK CURRENT    TOTAL    BLOCK CURRENT    TOTAL    BLOCK CURRENT    TOTAL    BLOCK CURRENT    TOTAL
  401       0      445      411       0      410      421       0      410      431       0      402      441       0     4123
  402       0      437      412       0      410      422       0      410      432       0       78      442       0       83
  403       0      437      413       0      410      423       0      410      433       0        5      443       0        6
  404       0      437      414       0      267      424       0      410      434       0        5      444       0        6
  405       0      129      415       0        0      425       0      410      435       0      397      445       0        6
  406       0        2      416       0        0      426       0      384      436       0     1137      446       0       77
  407       0        2      417       0        0      427       0      410      437       0     4314      447       0       77
  408       0      435      418       0        0      428       0      408      438       0     4314      448       0     4308
  409       0     7251      419       0        0      429       0      402      439       0     4313      449       0     4308
  410       0      410      420       0        0      430       0      402      440       0     4307      450       0     4308

BLOCK CURRENT    TOTAL    BLOCK CURRENT    TOTAL    BLOCK CURRENT    TOTAL    BLOCK CURRENT    TOTAL    BLOCK CURRENT    TOTAL
  451       0     4308      461       0       26      471       0        0      481       0      401      491       0      470
  452       0     4308      462       0     4202      472       0        0      482       0      399      492       0      470
  453       0     4100      463       0     7105      473       0        0      483       0      392      493       0      469
  454       0     4308      464       0      401      474       0        0      484       0      392      494       0      468
  455       0     4296      465       0      401      475       0      401      485       0      392      495       0      234
  456       0     4228      466       0      401      476       0      401      486       0       50      496       0        1
  457       0     4228      467       0      401      477       0      401      487       0        2      497       0        1
  458       0     4228      468       0      328      478       0      401      488       0        2      498       0        1
  459       0     1355      469       0        0      479       0      401      489       0      390      499       0        1
  460       0       26      470       0        0      480       0      389      490       0     2154      500       0        0

BLOCK CURRENT    TOTAL    BLOCK CURRENT    TOTAL    BLOCK CURRENT    TOTAL    BLOCK CURRENT    TOTAL    BLOCK CURRENT    TOTAL
  501       0        0      511       0      455      521       0       40      531       0        0      541       0      290
  502       0      469      512       0      455      522       0       20      532       0      289      542       0      290
  503       0      469      513       0      118      523       0       20      533       0      289      543       0       28
  504       0      469      514       0        3      524       0       20      534       0      290      544       0       28
  505       0      469      515       0        3      525       0       20      535       0        0      545       0       28
  506       0      469      516       0      452      526       0       20      536       0        0      546       0       28
  507       0      397      517       0      943      527       0       20      537       0        0      547       0       28
  508       0      469      518       0       28      528       0      289      538       0      290      548       0       28
  509       0      468      519       0       28      529       0        5      539       0      290      549       0       28
  510       0      455      520       0        8      530       0        0      540       0      290      550       0       28
```

```
BLOCK CURRENT    TOTAL   BLOCK CURRENT    TOTAL   BLOCK CURRENT    TOTAL   BLOCK CURRENT    TOTAL   BLOCK CURRENT    TOTAL
 551       0        28    561       0        81    571       0        97    581       0        97    591       0      4573
 552       0        28    562       0        81    572       0        97    582       0        97    592       0      4798
 553       0        40    563       0        81    573       0        97    583       0      5128    593       0      4907
 554       0        20    564       0        81    574       0        97    584       0      5504    594       0      8047
 555       0        19    565       0        81    575       0        97    585       0      4667    595       0      8047
 556       0        20    566       0        81    576       0        97    586       0      4667    596       0      1263
 557       0         3    567       0        81    577       0        97    587       0      4573    597       0      1263
 558       0       112    568       0        81    578       0        97    588       0      4573    598       0      1263
 559       0        40    569       0        81    579       0        97    589       0      4573    599       0      1263
 560       0       160    570       0        97    580       0        97    590       0      4573    600       0      5836

BLOCK CURRENT    TOTAL   BLOCK CURRENT    TOTAL   BLOCK CURRENT    TOTAL   BLOCK CURRENT    TOTAL   BLOCK CURRENT    TOTAL
 601       0      5478    611       0         0    621       0       337    631       0       565    641       0        28
 602       0      5768    612       0         0    622       0      3672    632       0       565    642       0        20
 603       0      4003    613       0        28    623       0      3672    633       0      3660    643       0        20
 604       0       331    614       0        28    624       0      3672    634       0      3660    644       0        20
 605       0       331    615       0       337    625       0      3672    635       0      3660    645       0        20
 606       0       331    616       0       337    626       0      4093    636       0      3660    646       0        28
 607       0       331    617       0       337    627       0       565    637       0      3660    647       0       111
 608       0       221    618       0       337    628       0         0    638       0      3470    648       0       111
 609       0        28    619       0       337    629       0         0    639       0      3660    649       0        75
 610       0         0    620       0       263    630       0         0    640       0        28    650       0        43

BLOCK CURRENT    TOTAL   BLOCK CURRENT    TOTAL   BLOCK CURRENT    TOTAL   BLOCK CURRENT    TOTAL   BLOCK CURRENT    TOTAL
 651       0         0    661       0        10    671       0        56    681       0       173    691       0       186
 652       0         0    662       0        10    672       0         6    682       0         0    692       0       112
 653       0       333    663       0        10    673       0        59    683       0         0    693       0         6
 654       0       111    664       0        72    674       0        59    684       0         0    694       0         6
 655       0       222    665       0        72    675       0         0    685       0       173    695       0       106
 656       0       333    666       0        72    676       0       101    686       0       101    696       0       186
 657       0       333    667       0        36    677       0        30    687       0       101    697       0       186
 658       0       333    668       0        36    678       0       101    688       0       101    698       0       333
 659       0        30    669       0        36    679       0       110    689       0        72    699       0       333
 660       0        30    670       0        56    680       0       173    690       0       186    700       0       111

BLOCK CURRENT    TOTAL   BLOCK CURRENT    TOTAL   BLOCK CURRENT    TOTAL   BLOCK CURRENT    TOTAL   BLOCK CURRENT    TOTAL
 701       0       333    711       0     17157
 702       0     25698    712       0     13590
 703       0     25985    713       0     13636
 704       0     25985    714       0     13636
 705       0      8828    715       0        69
 706       0       353    716       0        69
 707       0       353    717       0        69
 708       0      8475
 709       0      8475
 710       0     17157
```

```
                                    ****************************************
                                    *                                      *
                                    *             USER CHAINS              *
                                    *                                      *
                                    ****************************************

USER CHAIN       TOTAL        AVERAGE        CURRENT        AVERAGE        MAXIMUM
                ENTRIES      TIME/TRANS      CONTENTS       CONTENTS       CONTENTS
   MAINC          4123        206.674                        12.680           153
     FCH          2162        267.294             3           8.599            31
     ACH          7279        350.811            46          37.999            65
     BCH          1138        200.007             3           3.387            15
     JCH           945        267.903             3           3.767            16
   PTRNC           290        442.155                         1.908            20
   SKCKC           724       1507.440            60          16.240            71
   CRTEC            98        287.285                          .418             5
   DEEXC           618         75.906             1            .698            41
   SCNTC          4899        111.655            16           8.139           231
   STOFC          2346        149.248             4           5.210           105
   YMCSC          1206        126.582                         2.271            63
   YKCSC           232         87.969                          .303            14
   DRYMC           537         84.059                          .671            24
   AMHEC           389        234.964                         1.360            18
   BMHEC           267         66.715                          .265            12
   FMHEC           328         80.234                          .391            15
   JMHEC           234         80.670                          .280            11
   HVYPC           228        430.140             1           1.459            10
   LITPC          4093        409.713            12          24.954           106
   DRTEC          2148        884.417            92          28.269           119
   THREE          5039       2850.916           261         213.776           302
     TWO          2199        735.309            31          24.061            52
     ONE          2643          2.065             1            .081             9
   DLVRC          1496       2609.096            70          58.083            91
   BIKEC          7109        176.599             9          18.682           200
     MCH          7178        562.773            97          60.112           102
   ATRNC          4573         37.174                         2.529            81
   BTRNC          1263         28.735                          .540            17
   DUTYC            43        121.534                          .077             6
```

```
                                    **************************************
                                    *                                    *
                                    *              STORAGES              *
                                    *                                    *
                                    **************************************


                                                      -AVERAGE  UTILIZATION  DURING-
 STORAGE   CAPACITY   AVERAGE   ENTRIES    AVERAGE     TOTAL    AVAIL.   UNAVAIL.  CURRENT    PERCENT     CURRENT   MAXIMUM
                      CONTENTS            TIME/UNIT    TIME      TIME     TIME     STATUS  AVAILABILITY  CONTENTS  CONTENTS
   SKCK          6       .111      2489      2.994     .018      .077     .000      NA        23.8                       6
   CRTE          5       .081      1766      3.087     .016      .068     .000      NA        23.8                       5
   DRTE          2       .208      4655      3.001     .103      .434     .000      NA        23.8                       2
   DEEX          2       .044       906      3.262     .021      .092     .000      NA        23.8                       2
   SCPR     100000       .000      6946       .000     .000                                  100.0                       1
   CSPR     100000       .000      2642       .000     .000                                  100.0                       1
   SCNT          4       .269      5940      3.044     .067      .282     .000      NA        23.8                       4
   STOF          1       .117      2619      2.998     .116      .490     .000      NA        23.8                       1
   DLVR     100000      3.175      1426    149.621     .000                                  100.0                      91
   YMCS         11      1.118      1453     51.714     .101      .388     .011      NA        23.8                      11
   YKCS          4       .391       506     51.974     .097      .366     .013      NA        23.8                       4
   DRYN          2       .214       679     21.227     .107      .434     .004      NA        23.8                       2
   ANHE          2       .355       446     53.504     .177      .696     .015      NA        23.8                       2
   BNHE          2       .174       410     28.451     .086      .355     .002      NA        23.8                       2
   MAIN          8      1.535      4308     23.952     .191      .781     .007      NA        23.8                       8
   FNHE          1       .096       401     16.035     .095      .396     .001      NA        23.8                       1
   JNHE          4       .390       469     55.951     .097      .367     .013      NA        23.8                       4
   ATRN      32000   1373.081   2493603     37.003     .042                                  100.0                   31998
   BTRN      32000   1324.309   3019653     29.471     .041                                  100.0                   31986
   PTRN      32000     37.344    313686      8.000     .001                                  100.0                   22221
   LITP          5      1.138      3660     20.899     .227      .925     .009      NA        23.8                       5
   HVYP          3       .583       337    116.279     .194      .704     .035      NA        23.8                       3
   DUTY          2       .082       333     16.462     .040                                  100.0                       2
   BIKE     100000      2.209      7100     20.912     .000                                  100.0                     200
```

```
                                              ****************************************
                                              *                                      *
                                              *                QUEUES                *
                                              *                                      *
                                              ****************************************

QUEUE      MAXIMUM    AVERAGE      TOTAL       ZERO     PERCENT      AVERAGE      $AVERAGE      TABLE     CURRENT
          CONTENTS    CONTENTS    ENTRIES    ENTRIES     ZEROS     TIME/TRANS    TIME/TRANS    NUMBER    CONTENTS
QSKCK          213      48.743      7677       5502       71.6       426.674      1506.013                    180
QCRTE           18       1.259      5370       5136       95.6        15.755       361.563
QDRTE          357      84.814     14241       7791       54.7       400.220       883.650                    276
QSCPR         1035     713.513     21714         12         .0      2208.166      2209.387                    876
QCSPR           27        .243      7929       1479       18.6         2.065         2.539                      3
QDEEX          123       2.117      2724        870       31.9        52.237        76.750                      3
QSCNT          693      24.574     17898       3201       17.8        92.266       112.362                     48
QSTOF          315      15.700      7881        849       10.7       133.872       150.034                     12
QDLVR          273     174.250      4488         15         .3      2609.096      2617.845                    210
QBIKE          600      56.046     21393        174         .8       176.054       177.498                     27
QYMCS          189       6.917      4386        975       22.2       105.980       136.274
QYKCS           42        .920      1524        828       54.3        40.606        88.913
QDRYW           72       2.015      2046        435       21.2        66.187        84.059
QAMHE           54       4.171      1338        219       16.3       209.488       250.487
QBTRN          258     135.820      3945         42        1.0      2313.599      2338.495                    156
QBWHE           36        .795      1230        429       34.8        43.446        66.715
QMAIN          459      38.052     12942       1068        8.2       197.582       215.354
QATRN          357     206.345     14019                    .0       989.117       989.117                    300
QFWHE           45       1.174      1203        219       18.2        65.628        80.234
QJMHE           33        .851      1410        711       50.4        40.597        81.892
QPTRN           60       5.724       870                    .0       442.155       442.155
QHVYP           30       4.383      1014        414       40.8       290.473       490.899                      3
QLITP          318      74.889     11016        471        4.2       456.842       477.247                     36
DUTYQ            8        .119       333        143       42.9        24.096        42.231
 $AVERAGE TIME/TRANS = AVERAGE TIME/TRANS EXCLUDING ZERO ENTRIES
```

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                                              ****************************************
                                              *                                      *
                                              *                TABLES                *
                                              *                                      *
                                              ****************************************

TABLE    ALL
ENTRIES IN TABLE          MEAN ARGUMENT          STANDARD DEVIATION          SUM OF ARGUMENTS
           25985               4601.589                    3488.000             119572384.000        NON-WEIGHTED

          UPPER       OBSERVED      PER CENT      CUMULATIVE      CUMULATIVE      MULTIPLE      DEVIATION
          LIMIT      FREQUENCY      OF TOTAL      PERCENTAGE       REMAINDER       OF MEAN      FROM MEAN
              0              0           .00              .0           100.0         -.000         -1.319
           1200           4201         16.16            16.1            83.8          .260          -.975
           2400            889          3.42            19.5            80.4          .521          -.631
           3600          10155         39.08            58.6            41.3          .782          -.287
           4800            525          2.02            60.6            39.3         1.043           .056
           6000           2538          9.76            70.4            29.5         1.303           .400
           7200            624          2.40            72.8            27.1         1.564           .744
           8400           2958         11.38            84.2            15.7         1.825          1.088
           9600            603          2.32            86.5            13.4         2.086          1.433
          10800           2274          8.75            95.3             4.6         2.347          1.777
          12000            189           .72            96.0             3.9         2.607          2.121
          13200            669          2.57            98.6             1.3         2.868          2.465
          14400             39           .15            98.7             1.2         3.129          2.809
          15600            159           .61            99.3              .6         3.390          3.153
          16800             15           .05            99.4              .5         3.650          3.497
          18000             96           .36            99.8              .1         3.911          3.841
          19200              3           .01            99.8              .1         4.172          4.185
          20400              9           .03            99.8              .1         4.433          4.529
          21600              3           .01            99.8              .1         4.694          4.873
          22800             18           .06            99.9              .0         4.954          5.217
          24000              0           .00            99.9              .0         5.215          5.561
       OVERFLOW             18           .06           100.0              .0
    AVERAGE VALUE OF OVERFLOW        25119.00

TABLE    IPGON
ENTRIES IN TABLE          MEAN ARGUMENT          STANDARD DEVIATION          SUM OF ARGUMENTS
             353                760.742                     342.000                268542.000        NON-WEIGHTED

          UPPER       OBSERVED      PER CENT      CUMULATIVE      CUMULATIVE      MULTIPLE      DEVIATION
          LIMIT      FREQUENCY      OF TOTAL      PERCENTAGE       REMAINDER       OF MEAN      FROM MEAN
              0              0           .00              .0           100.0         -.000         -2.224
           1200            332         94.05            94.0             5.9         1.577          1.284
           2400             21          5.94           100.0              .0         3.154          4.793
REMAINING FREQUENCIES ARE ALL ZERO
```

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TABLE   IPGTW
ENTRIES IN TABLE          MEAN ARGUMENT           STANDARD DEVIATION          SUM OF ARGUMENTS
        8475                   2720.000                     2266.000             23052000.000         NON-WEIGHTED

            UPPER          OBSERVED          PER CENT         CUMULATIVE       CUMULATIVE       MULTIPLE         DEVIATION
            LIMIT          FREQUENCY         OF TOTAL         PERCENTAGE        REMAINOER        OF MEAN         FROM MEAN
                0                  0              .00                 .0            100.0           -.000           -1.200
             1200               2918            34.43               34.4             65.5            .441            -.670
             2400                508             5.99               40.4             59.5            .882            -.141
             3600               3438            40.56               80.9             19.0           1.323             .388
             4800                102             1.20               82.1             17.8           1.764             .917
             6000                225             2.65               84.8             15.1           2.205            1.447
             7200                216             2.54               87.3             12.6           2.647            1.977
             8400               1041            12.28               99.6               .3           3.088            2.506
             9600                 15              .17               99.8               .1           3.529            3.036
            10800                 12              .14              100.0               .0           3.970            3.565
REMAINING FREQUENCIES ARE ALL ZERO

TABLE   IPGTH
ENTRIES IN TABLE          MEAN ARGUMENT           STANDARD DEVIATION          SUM OF ARGUMENTS
       17157                   5610.058                     3580.000             96251840.000         NON-WEIGHTED

            UPPER          OBSERVED          PER CENT         CUMULATIVE       CUMULATIVE       MULTIPLE         DEVIATION
            LIMIT          FREQUENCY         OF TOTAL         PERCENTAGE        REMAINDER        OF MEAN         FROM MEAN
                0                  0              .00                 .0            100.0           -.000           -1.567
             1200                951             5.54                5.5             94.4            .213           -1.231
             2400                360             2.09                7.6             92.3            .427            -.896
             3600               6717            39.15               46.7             53.2            .641            -.561
             4800                423             2.46               49.2             50.7            .855            -.226
             6000               2313            13.48               62.7             37.2           1.069             .108
             7200                408             2.37               65.1             34.8           1.283             .444
             8400               1917            11.17               76.2             23.7           1.497             .779
             9600                588             3.42               79.7             20.2           1.711            1.114
            10800               2262            13.18               92.9              7.0           1.925            1.449
            12000                189             1.10               94.0              5.9           2.139            1.784
            13200                669             3.89               97.9              2.0           2.352            2.120
            14400                 39              .22               98.1              1.8           2.566            2.455
            15600                159              .92               99.0               .9           2.780            2.790
            16800                 15              .08               99.1               .8           2.994            3.125
            18000                 96              .55               99.7               .2           3.208            3.460
            19200                  3              .01               99.7               .2           3.422            3.796
            20400                  9              .05               99.7               .2           3.636            4.131
            21600                  3              .01               99.7               .2           3.850            4.466
            22800                 18              .10               99.8               .1           4.064            4.801
            24000                  0              .00               99.8               .1           4.278            5.136
         OVERFLOW                 18              .10              100.0               .0
    AVERAGE VALUE OF OVERFLOW            25119.00
```

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                                        ****************************************
                                        *                                      *
                                        *         FULLWORD SAVEVALUES          *
                                        *                                      *
                                        ****************************************


NUMBER - CONTENTS   NUMBER - CONTENTS   NUMBER - CONTENTS   NUMBER - CONTENTS   NUMBER - CONTENTS   NUMBER - CONTENTS
REQCT        39780  PRION          519  PRITW        12861  PRITH        26400  PNUM            20  ANUM            81
 BNUM           97  NISCT        13636   WRCT           69
END

                       ***** TOTAL RUN TIME (INCLUDING ASSEMBLY) = 4.74 MINUTES *****
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